MODERN PLASTICS

E. F. LOUGEE, Editor
C. A. BRESKIN, Publisher
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MARCH 1938
VOLUME 15
NUMBER 7

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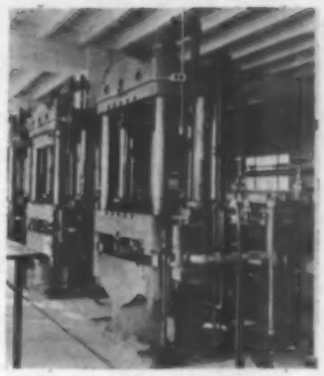
Cover color this month NEWPORT GREEN (Created by Textile Color Card Association)



Next Month

A new plastic molding plant has been established at Cambridge, Ohio, by Reynolds Spring Co. to supplement the Jackson, Mich., plant which has long since over-reached its normal capacity of production. The new plant, which is a revelation of cleanliness and progressive arrangement, will be pictured and described in our April issue.

Published the 5th of each month, by Breskin & Charlton Publishing Corporation. Publication office, 20th and Northampton Sts., Easton, Pa. Advertising, editorial and general offices at 425 Fourth Ave., New York, N. Y. Telephone Ashland 4-0655. Western office, 221 N. La Salle St., Room 620, Chicago, Illinois. Telephone Randolph 6336.

PUBLISHERS OF MODERN PACKAGING, PACKAGING CATALOG, MODERN PLASTICS

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Subscription price $5.00 per year in United States, its possessions, and Canada. All other countries, $6.00 per year. Price this issue 50c per copy. Copyright 1938 by Breskin & Charlton Publishing Corporation. All rights reserved. Published in U. S. A. Acceptance under the Act of June 5, 1934, at Easton, Pa., authorized Nov. 24, 1936. Back numbers dated 3 months or more preceding current issue, when available, $1.00 per copy.

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MODERN PLASTICS
MARCH 1938 VOLUME 15 NUMBER 7

AS A MATTER OF RECORD

by FRANK N. GUNDERSON*

Cellulose acetate film makes permanent photographic records of business and news

MANY ARE FAMILIAR WITH THE USE OF CELLULOSE acetate for the making of tough unbreakable plastics. Makers of modern hardware have found that doorknobs made of plastics are better than the traditional knobs made of metal, glass and porcelain. Automobile manufacturers have learned that plastics are ideal for instrument panels, dome lights, steering wheels, etc. Many, however, do not know that film base made from the same cellulose acetate used in the making of plastics, and commonly called safety film base, plays an important part in the office routine of modern business.

Cellulose acetate film base, coated with a specially developed fine-grain emulsion and used in specially constructed high speed photographing machines, is standard equipment in hundreds of banks, department stores, insurance offices, engineering concerns, government departments, etc., throughout the United States, and film is also being used in the same connection in Canada and in Europe. Film is used particularly in connection with accounting routines, destruction of record programs, duplicate filing systems, etc.

A few years ago, a prominent official in one of the larger New York banks, who was particularly interested in the bookkeeping problem of the bank, conceived the idea of photographing bank checks as a means of keeping a permanent record of these checks after they had been returned to depositors. This film, containing pictures of checks, would provide a tamper-proof, extraction-proof record of the returned checks and would not only provide a valuable file for the bank, but would serve as a convenience to depositors who might lose cancelled checks and then need them badly to prove payment of questioned bills.

Within a comparatively short time, a majority of banks in Greater New York were photographing their checks with special photographic equipment on cellulose acetate film, and banks all over the country were asking when photographing equipment would be available so that they too could improve their systems through accounting with photography. As the news of the success of keeping bank records on motion picture type safety film circulated through the business world, other commercial organizations demanded to know why film could not be used in connection with their accounting routines. It could, and in no time at all department stores were dispensing with continuous ledger cards, or fold-over bill systems and instead, were keeping duplicate records of accounts receivable on tiny rolls of acetate film. Special photographing equipment was so constructed that two film pictures of each record could be made simultaneously, one film to be projected in specially developed desk type reading projectors for reference to the records, and the other to be filed away in a film vault as protection against loss.

A 100-foot roll of 16 mm. cellulose acetate film may be filed in a box 4 in. square by $^3/_4$ in. thick and contains film pictures of approximately 8000 ordinary sized bank checks or 4000 standard sized department store statements. The use of film equipment enables department stores to post much more rapidly and consequently makes possible a reduction in the number of billing ma-

* Recordak Corp., subsidiary of Eastman Kodak Corp.

1. Opaque screen projector to show standard full size department store statements from 16 mm. cellulose acetate film. Many stores have adopted cellulose acetate film to keep Accounts Receivable and this film becomes their principal record of accounts after the statements are mailed to customers. 2. Translucent screen projector showing the operator making a duplicate copy of a bank statement from the projected film image. 3. Common type insurance cards are being fed into this photographing unit. These records can be photographed as rapidly as 100 a minute and about 4800 cards this size require only a 100 foot roll of film. 4. Rapid photography of unbound business records on 16 mm. film can be accomplished on this automatic machine. The operator needs only to place the material into the feeding hopper and as many as 100 checks or about 70 letter size documents can be photographed per minute. 5. Photographically reproducing a bound newspaper volume at the rate of 15 pages a minute. 6. Library projector developed to show 16 mm. and 35 mm. films of newspapers, books and such. A large number of these machines are used by the United States Government, universities and public libraries throughout the country. 7. A reader in a public library refers to a film copy of a current newspaper. 8, 9. Photographing census records in card form and from large books at the U. S. Department of Commerce, Bureau of Census. (All photos courtesy Recordak Corporation.)

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chines required, a saving in operating costs, and provides a more accurate and safe record of accounts receivable.

Engineering concerns, with files of thousands of valuable tracings and blueprints, constantly in fear of loss of these invaluable records through fire, explosion and flood, photograph them on 16 mm. and 35 mm. film so as to have a duplicate file that can be stored away for safekeeping and can be referred to in case of loss of any of the original records. From the films, paper enlargements can be made either original size or a fraction of original size, depending on the requirements. Due to the speed of the photographing operation, in most cases engineering organizations accumulate a sizable stack of filing and then operate the equipment only for the time required to actually photograph their files.

Insurance companies, with expensive filing cabinets containing millions of inactive loan record cards and policy briefs (occupying floor space worth several dollars per square foot) photograph these valuable card records and destroy the originals. In this way these filing cabinets are released for active files or the space they formerly occupied is made available for other uses.

One organization whose credit department is constantly referring to ledger records which are being posted daily by billers, photographs all ledger records on film weekly and now all reference by the various credit men is by means of film in projectors. Each credit man has a projector on his desk with a roll of 16 mm. cellulose acetate film containing pictures of all of the accounts in his particular territory.

Other organizations with duplicate files of records entailing expensive dual filing systems have eliminated one file completely for the sake of safety by photographing the master file on 16 mm. film. In no other way could as accurate a duplicate file be made at such low cost, nor could one be kept in such a small space.

The use of cellulose acetate film in business is now an accepted step and its uses (*Please turn to page 62*)

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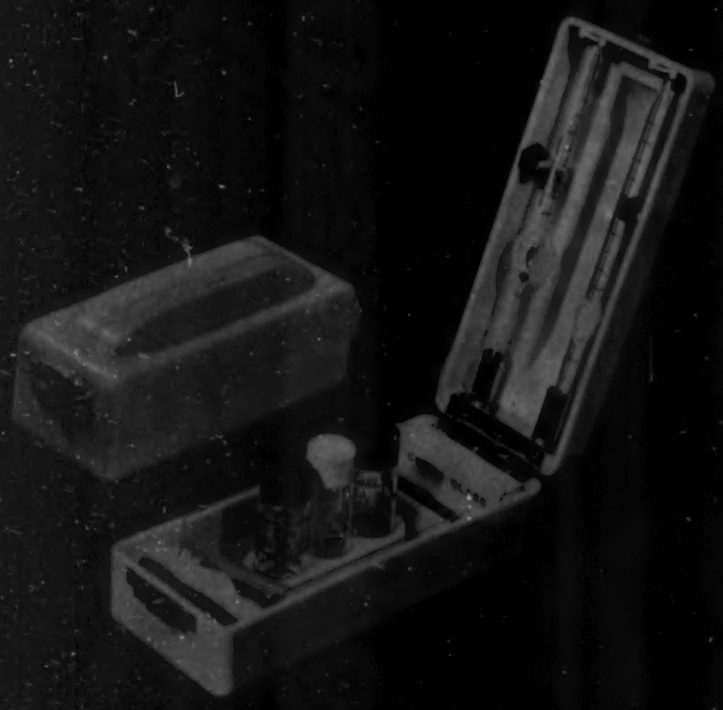
PLASTIC WINNERS IN THE ALL-AMERICA PACKAGE COMPETITION



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1. Gold award: Hemotological case molded by General Electric Co. of Plaskon for the Bard-Parker Co. Inc. The closures on the three vials are molded by Colt's Patent Fire Arms Mfg. Co. This compact medical kit for taking blood smears, is light weight, easily cleaned and has a permanent finish.

2. Silver award: Kem Royal Gift Box molded of Lucite by the Gorham Company for the Kem Card Sales Corp. The transparency of the plastic permits the design of the cards to show through in a pleasing pattern.

3. Bronze award: Wee-Tot set with jars molded of Plaskon by Colt's Patent Fire Arms Mfg. Co. for Harriet Hubbard Ayer, Inc. The jars which individually package body cream, talcum and absorbent cotton, will squeak when pressed, delighting the baby as well as being attractive and appropriate in design.

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"GEE, MOM, WERE THEY ALL POOR PEOPLE?"

WE LIKE THIS ILLUSTRATION AND CAPTION used recently by General Electric Company for an institutional advertisement in *Wharton's Review* because it so clearly depicts by contrast, the advancement made within the memory of our present generation through the use of new materials, inventions and design.

The advertisement, of course, was created to point out that when electricity came, modes of living changed. New conveniences became available at moderate costs. It goes on to say, "Even as late as 1900, only one American home in every seven had a bathtub; one in thirteen had a telephone; one home in thirty had electric lights. There were only 8,000 automobiles.... Today there are twenty million bathtubs, eighteen million telephones, twenty-two million wired homes, twenty-five million automobiles and millions of other manufactured products which were unheard of in 1900 but are now plentiful and sell at a fraction of their former cost."

Also since 1900, industry has been given new materials with which to work and these new materials, particularly plastics, have been responsible in a big way for these "*other manufactured products which were unheard of in 1900 but are now plentiful and sell at a fraction of their former cost.*"

The radio, for example, has brought into millions of homes better music (and worse) than was ever possible with the gramophones and phonographs of 1900. Through the principles of radio, recorded music has been given tone fidelity and volume control never dreamed of at that time. Without plastics (phenolic and styrene) as insulation, radios would still be costly and rare. Without plastics (vinyl and acetate) records probably would still be made of wax and shellac with their inherent squeaks, scratches and distortions of true tone.

Although molded and laminated plastics have never been used to their greatest advantage in radio design, they provide designers with a (*Please turn to page 60*)

DISPLAYS THAT LOOK REAL

Three-dimensional reproduction of merchandise containers and lettering in translucent plastic material

DISPLAYS TO BE SUCCESSFUL SHOULD TELL their story at a glance, and an advertised product should be pictured so that its package, or label, its size and shape will impress itself upon the observer's mind.

It had long been common practice in the liquor industry to use dummy glass bottles filled with colored water for window trims and counter displays. This involved considerable expense in shipping and packing because breakage was frequent, both in transit and in use. Then came a law prohibiting the use of colored water or any imitation of whiskey or wine content. Obviously this meant that either the alcoholic beverage itself had to be used or a practical substitute found. The advertising department of the James Clark Distilling Company, for example, found that "phantom bottles" made of cellulose acetate were an improvement over the dummy glass bottle which they have replaced. The front half of the actual size orginal bottle was meticulously duplicated and molded of transparent cellulose acetate. Its inside was covered with a thin translucent coat of paint, the exact color of whiskey, and the actual label of the company's product was then pasted on the outside. To the observer a cleverly reproduced whiskey bottle was pleasingly displayed on window or counter cards.

Realistic Displays, Inc., are sole owners of the patented process by which phantom bottles and various other articles, particularly packages, are produced, in cellulose acetate or nitrocellulose dummies so accurately that it is difficult to distinguish them from the genuine. These plastic replicas as well as letters in bold relief lend themselves readily to all forms of cut-out displays. They are practically unbreakable, light weight (shipping costs are cut to a minimum) and enjoy a long life compared with most paper or fiber displays.

The method of manufacture for either letters or facsimiles is substantially the same. A casting of the object or pattern is first produced in the usual manner using gypsum or similar material. Then a mold is made of some resistant material preferably metal with a highly polished interior surface. An upper die of tough but somewhat resilient leather or highly compressed cardboard prevents folds or plaitings in the thermoplastic material to be pressed. This plastic material is then introduced between the two pressing and shaping members after being heated to approximately 120 deg. C. The sheet should be quickly introduced into the press so it will not become substantially cooled and the operation of pressing takes but from (*Please turn to page 60*)

SCIENCE DEMANDS ACCURACY

Because plastics are non-conductors of heat they are ideally suited to housings where temperatures must be accurately read or controlled

AMONG THE INTERESTING SCIENTIFIC ENTRIES in our recent Competition was this Friez Hand-aspirated Psychrometer, a standard instrument for the measurement of moisture content of air used in the heating, ventilating, refrigeration and air-conditioning industries both for home comfort and industrial installations.

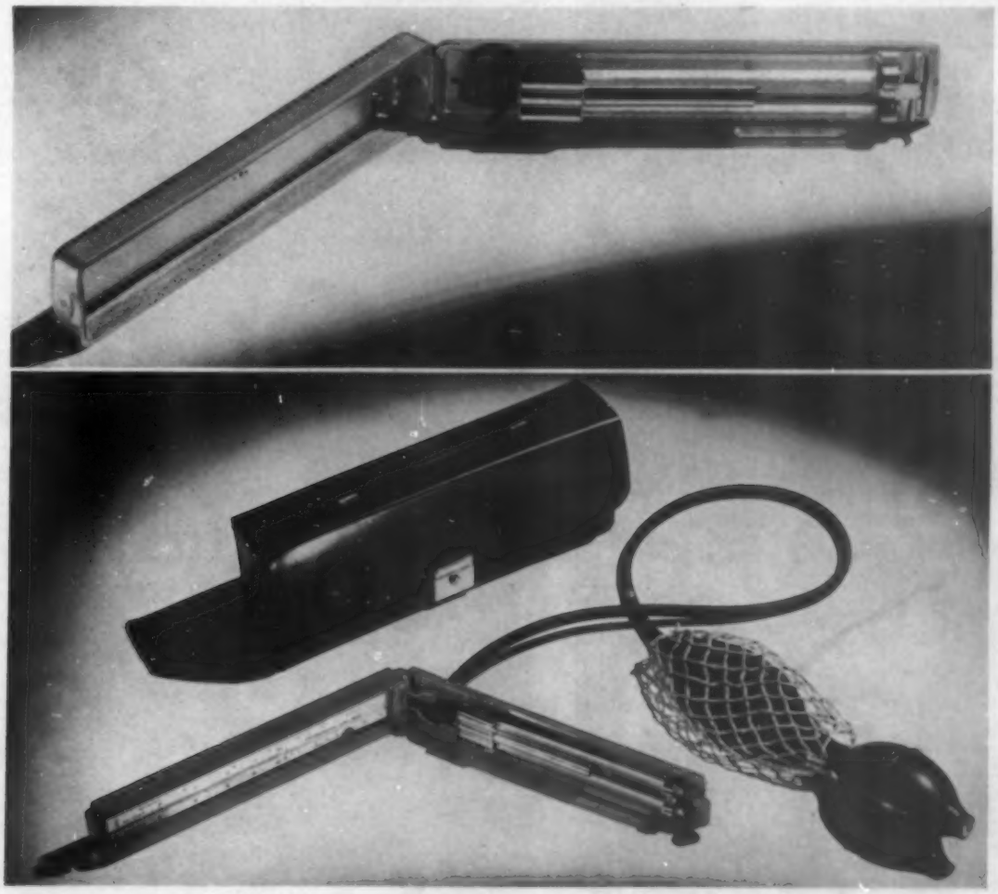
It is expected to replace gradually the more common sling-psychrometer which must be whirled around within the space where measurements are being made. This whirling operation requires considerable experience and skill if anything like accurate readings are to be obtained as a result.

Furthermore, a great deal of air-conditioning survey work has to be done in public buildings, theaters, stores and industrial plants, and the distraction to employees, customers and the natural foot traffic in such places created by a person whirling a sling-psychrometer is often objected to by building operators and plant managers. Similarly, the necessity of publicly using a sling-psychrometer is sometimes embarrassing to a professional engineer.

To overcome these objections and to provide an instrument of equal accuracy to a good sling-psychrometer in the hands of an expert operator, The Friez Company, a subsidiary of the Bendix Corp., designed this hand-aspirated model which largely removes the grave chances of error that exist with the ordinary sling device in the hands of somewhat less skilled operators.

The hand-aspirated instrument originally employed an aluminum case which the company admits cost too much, presented a poor appearance, and was too heavy for a pocket instrument. The (*Please turn to page 64*)

Top photo shows the old metal encased psychrometer, while the Arcolite housing of the new model molded by Consolidated Molded Products Corp., and the leather case are illustrated below



RADIO CONTROLS FOR 1938

In designing radios of 1938 it would seem that greater consideration has been given to those who will use them. Dials are more clearly marked, some being increased in size for easy reading; arm chair controls are sometimes provided; and automatic tuning has been introduced. Along with this, greater consideration has been given to the use of plastics in one way or another, especially in providing decorative escutcheons and bezels for radio dials.

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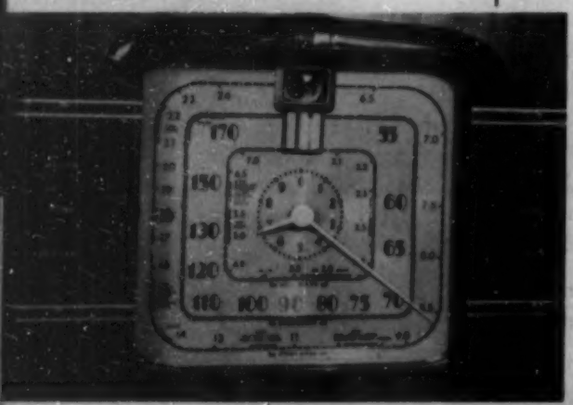

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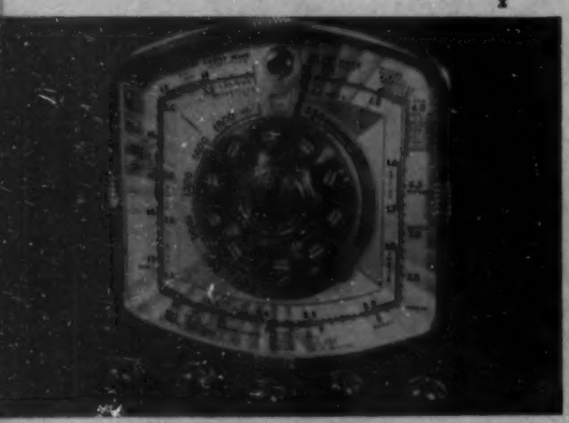

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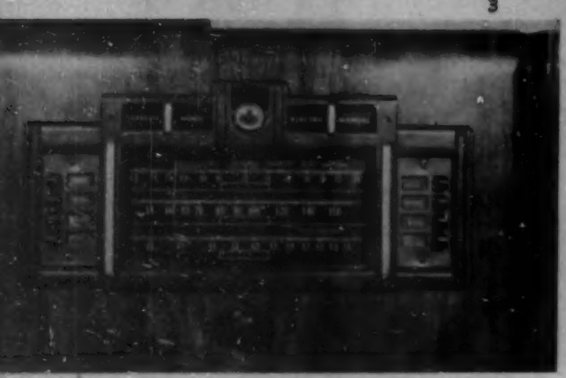

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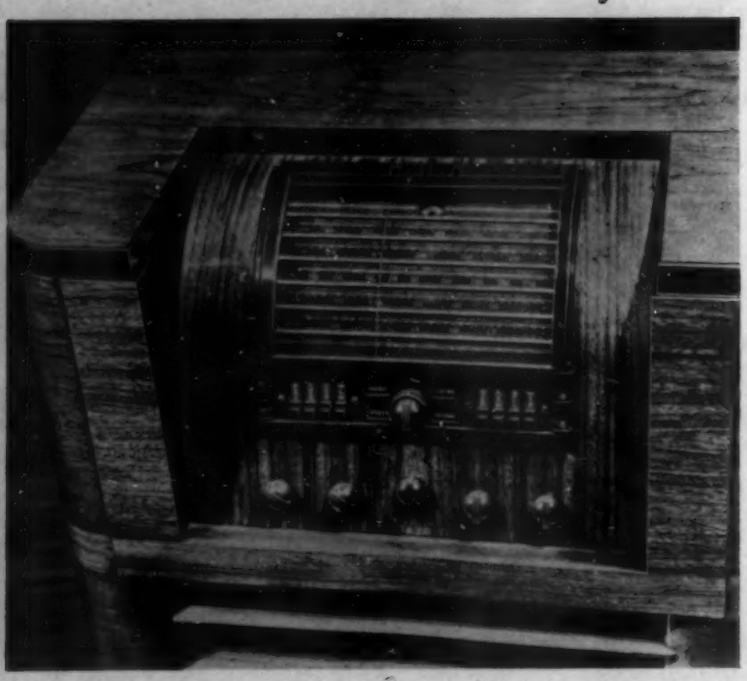

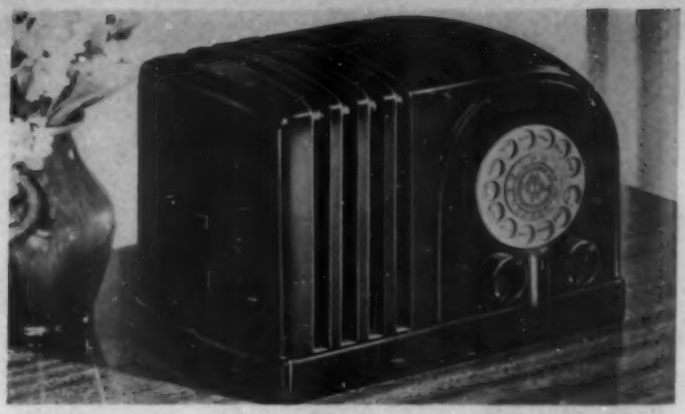

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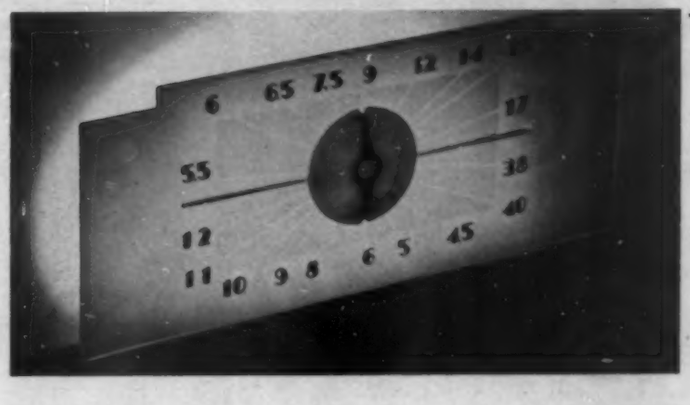

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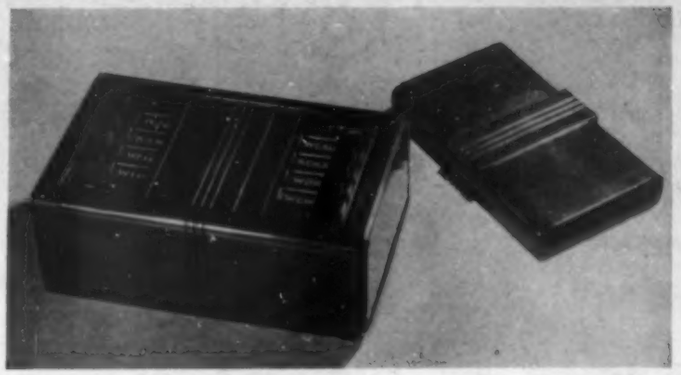

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1. The Sunburst radio dial on RCA Victor radio is molded of cellulose acetate because of this material's flexibility, translucence and the ease with which it can be combined with glass. The windows of the dials are an integral part of the acetate bezels molded around them.

2. Dial on this Garod Radio is metal laminated to a transparent pyroxylin sheet producing an engine turned effect. The surface is smooth and easily printed.

3. The RCA Victor straight line tuning dial has an injection molded acetate bezel, and phenolic push buttons for automatic control.

4. The Emerson automatic tuning arrangement logs numerous stations. A dealer "sets" the dial for the desired stations and then all that is necessary is to move the dial in the same manner as a telephone. Other stations may of course be tuned in the regular way.

5. Close-up of RCA "Overseas" radio dial. Foreign tuning is enormously simplified because the space allotted to foreign entertainment is greater than ever before and foreign stations may be clearly and distinctly marked by name.

6. Injection molded Teledial used on the Montgomery-Ward radio set. The center section where the dial markings are placed is thinner than the rest, so that light from behind will illuminate only the dial. Call letters are identified on translucent paper discs. This was a difficult engineering job because of the thirty-nine undercuts and the number of holes required for the dial.

7. A two-tone effect is achieved on this Colonial Radio plastic dial. When lighted from the rear, the raised figures and horizontal dividing line appear darker than the background. Additional gradation of color is obtained in the rectangle enclosed by the figures through the use of a slightly thicker section. Pointer button and shaft are molded separately from the dial which is injection molded of cellulose acetate.

8. An armchair tuning control box connects with the RCA automatic electric tuning radio. This molded control box has a duplicate set of push buttons for automatic tuning which appear on the front panel of the radio receiver.

9. The Piloscope tuning dial for foreign stations on the Pilot radio has a molded escutcheon combined with an etched plate-glass scale. Different colors identify different tuning bands. On the lower part of the dial, local and short wave stations are logged, the call letters appearing in colors corresponding to the particular tuning band which receives the wave.

10. The new transparent resins are beginning to make their appearance in the decorative motif of radio cabinets. This 1938 Wurlitzer displays bars of transparent methyl methacrylate across the sound box. The material has the clarity of glass with the added advantage of resistance to breakage and chipping.

HEADLINES FOR SPRING

by EVE MAIN

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LOUISEANDERS

The all-important upward sweep of hats and hair-do's brings a vogue for novel adaptations of plastic material and ornaments worn in original ways. (1) A pouf of jet black, ribbon-like strippings of slit cellulose film, billowing up in a high swirl becomes a neat turban accented by long black ribbon streamers. (2) Similar strippings, forming the wide flange of a new Watteau styling, contrast strikingly with the closely woven brim and shallow crown, also of slit cellulose film. The same scintillating black material is used as a bracelet cuff on the fabric gloves. (Photos courtesy Du Pont.) Shown at the Paris Exposition Internationale de la Coiffure: (3) Gleaming flowers of translucent plastic material, fastened to hairpins, nestle in loose curls piled high. Ornaments designed by Beier. (4) Cuesnin fashions a diadem of plastic stars with sparkling rhinestone centers for formal evenings. (5) Tiny plastic flower pins hold each curl in place in the bridal coiffure designed by Sievers. (Photos courtesy Du Pont Paris Office.)

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PLASKON

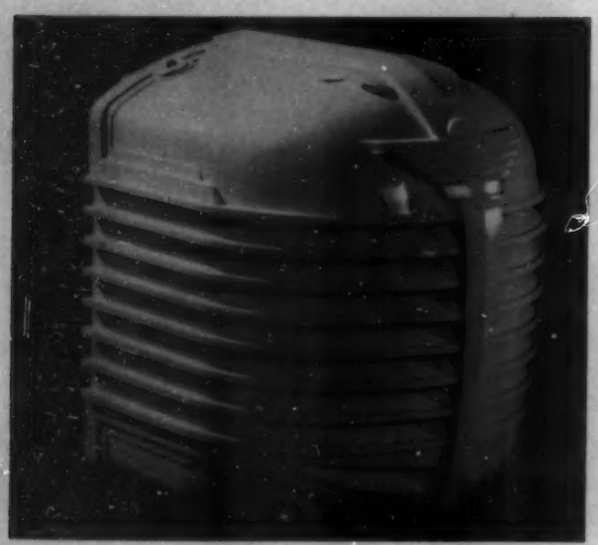
MOLDED COLOR

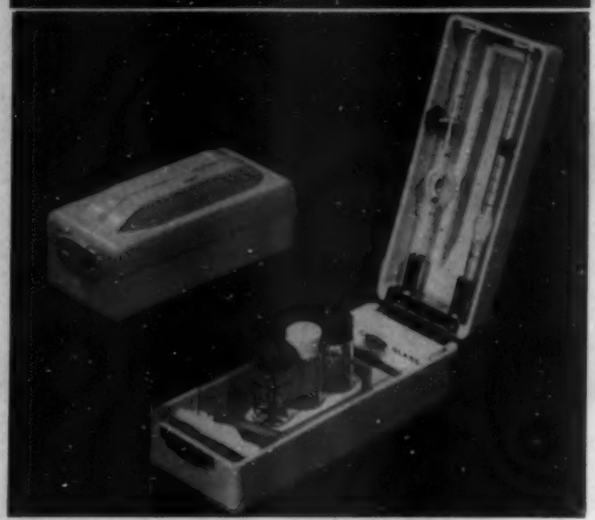
PLASKON FOR HEATERS:

Enter the "China Clipper"—Francisco's deluxe molded automobile heater—and enter a new era in heater design and materials. For here is an application made to order for colorful Plaskon—an application where its lustre, strength and moldability make it No. 1 material choice.

As any dealer can tell you, car heaters are bought from a counter, and their appearance there is even more important than their appearance in the car. Which means that the more beauty you can put in the housing, the better it sells.

Francisco chose Plaskon for Color—rich, appealing and non-yellowing Color—and for its chip-proof finish and non-resonant qualities. Plaskon housings do not rust, discolor or tarnish, and their lightness and toughness make them ideal for electrically energized appliances. Molded by Recto Molded Products, Inc.





PLASKON FOR WINNERS:

Gold Award and Bronze Award Winners in the All-America Packaging Competition were the two Plaskon products shown above. One is a blood count testing set by Bard-Parker Co., Inc., and the other is Harriet Hubbard Ayer's Wee-tot Set.

The former has a clean, white Plaskon case, into which bottles, cotton, glass and rubber tubing fit. The Wee-tot Set features pastel Plaskon jars equipped with buttons which produce squeaking sounds. G.E. molded the Bard-Parker Case and Colt's designed and molded the Wee-tot jars.

MARCH • 1938

PLASKON FOR RADIOS:

A radio 6½" wide—actually smaller than your hand—that's the new Detrola "Pee-Wee." Small it may be—but its molded Plaskon case and ingenious mechanism make it one of the fastest selling sets in radio history.

Dial, switch and legs are molded in contrasting colors. The main body is a one-piece Plaskon molding with grille-louvres, holes, ventilation slots and other details automatically formed in the molding operation. And like all Plaskon moldings, the "Pee-Wee" case will never fade, rust, chip or lose its lustre from frequent handling.

Four tubes, precision construction, a dynamic speaker and other features give the "Pee-Wee" the performance of larger sets. Detrola suggests it for hospital rooms, kitchens, offices, and for the traveler. Chicago Molded Products Corporation is the molder.

PLASKON FOR THERMOSTATS:

Nowhere do Plaskon's soft, rich colors fit so well as in home appliances, such as the thermostat case shown here. When colored plastics are needed to harmonize with home furnishings and to resist discoloration, designers think of Plaskon first.

Typical example of such a use is this thermostat of D. H. McCorkle Company, a one-piece molding of popular ivory Plaskon. It shows how Plaskon gives distinction to a simple design, without costly mold engraving. For Plaskon's translucence and depth gives it a surface interest of its own.

Remler Company, Ltd. is the molder.

PLASKON FOR YOUR PRODUCT:

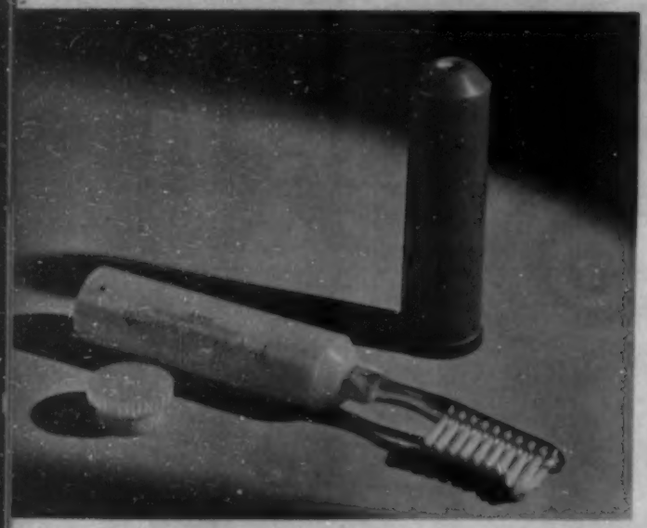
Write Plaskon Company for full information on Plaskon —the world's largest selling urea-formaldehyde plastic —and for suggestions on using it on your products.

PLASKON COMPANY

INCORPORATED

2121 SYLVAN AVENUE, TOLEDO, OHIO

CANADIAN AGENT: CANADIAN INDUSTRIES LIMITED, MONTREAL, P.Q.



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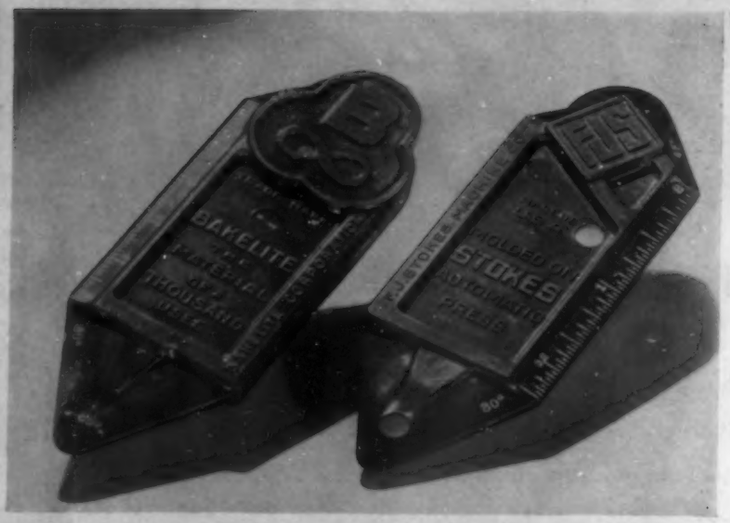

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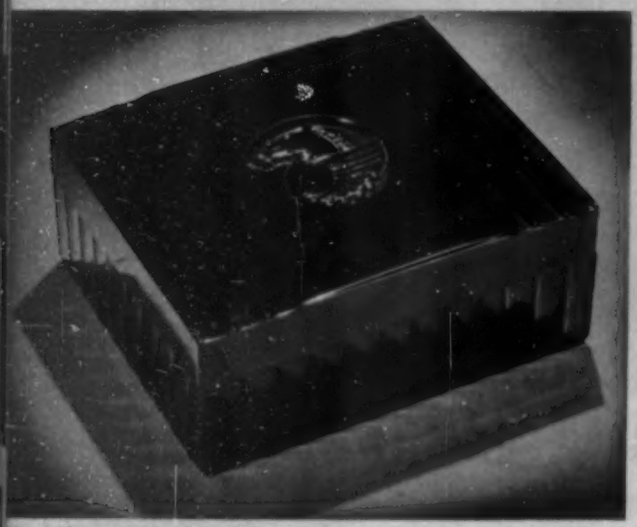

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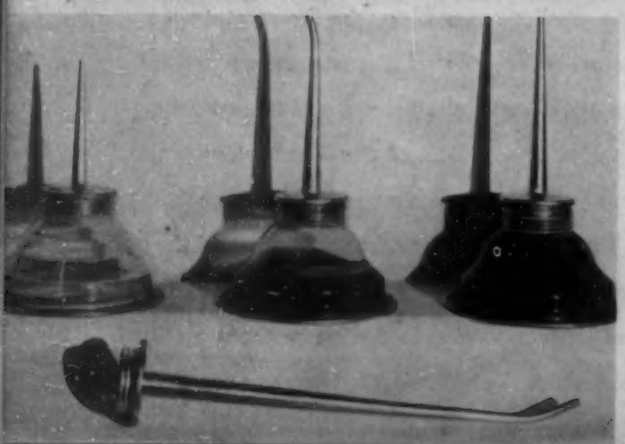

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IN REVIEW

1. "Travel Kit" is a traveling toothbrush and container which is compact, and assures no dampness reaching other articles in a suitcase. The brush block and attaching shank which also acts as container are made of Fiberloid

2. These small scales or rules of Bakelite were molded on an F. J. Stokes automatic press. Even with the rather heavy cross-section the pieces were made in less than 55 seconds for the complete cycle. Both the front and back of the rule are shown in the photograph

3. A box molded of Bakelite by Gorham Company in a beryllium copper molds packages the American Stationery Company's lower priced paper. The head of Pegasus molded into the cover indicates the possibilities of relieving plastic parts of undecorated monotony. The box measures 7½ in. by 6⅜ in., and 3⅜ in. high overall.

4. The motion picture industry continues to use plastics extensively for stage properties. In this "Manila Cafe" set Lumarith table lights made by Murray L. Rasch supply the actors with a flattering light

5. The transparent barrels on these cans are of Lucite which is unaffected by oil. They show at a glance the supply of oil and are fitted with metal spouts of varying lengths and metal bases. The oil is discharged by thumb pressure on the bottom of the can. Molded by Universal Plastics Corp. (patents pending)

6. A motion picture film developer is being molded for the Broms Camera of Bakelite by Automatic Moulded Products Corp. The tank is its own self-contained reel and a single spiral groove at the bottom holds the film coils firmly apart. No buckling or surface contacts can cause spots of undeveloped emulsion

7. This combination cabinet and mirror is an added convenience for the shaver. Through a translucent portion of the chromium-framed mirror there is adequate light from a bulb directly behind. A molded Durez base has room for accessories. Molded by Lanfare Molded Products for Acme Specialty Mfg. Co.

8. Steering wheels of Tenite similar to those adopted by the automotive industry are now offered as standard equipment on several models of the Chris-Craft runabouts. They are molded by American Hard Rubber Co.

9. Dispenser for household cleansing powder accommodates only its brand of package. It is identified by the Tenite medallion on the Plaskon cylinder. Molded by Chicago Molded Products Corp. for the Cameo Corp. and designed by Barnes & Reinecke

10. To display an electric light bulb, Climax Mfg. & Chemical Molding Corp. announces a handy Durez display device. It consists of a hollow cone-shaped molding with threads for various size bulbs and can be used for building individual or mass counter and window displays

11. Lampshades of plastics are not new, but it remained for the Royson Plasticraft Co. to turn out a good-looking practical plastic lamp base. It is fashioned from rod and tube stock of Catalin in a variety of colors in good taste

12. The American Safety Razor Corp. introduced this molded box for the Gem razor. Designed to hold the razor, a container for new blades and another for used blades, the package is neat and compact. Molded of Bakelite or Beetle in light and dark shades by Mack Molding Co.

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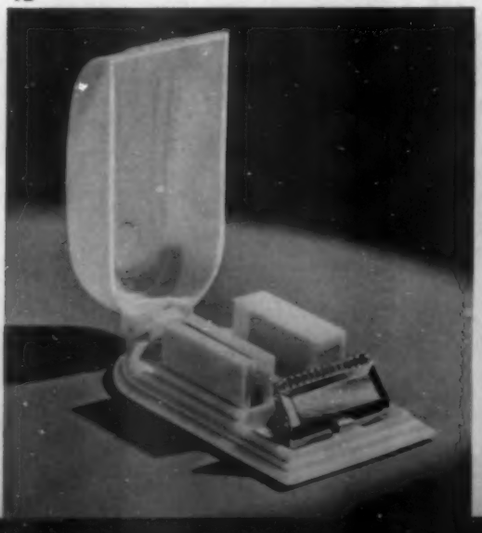
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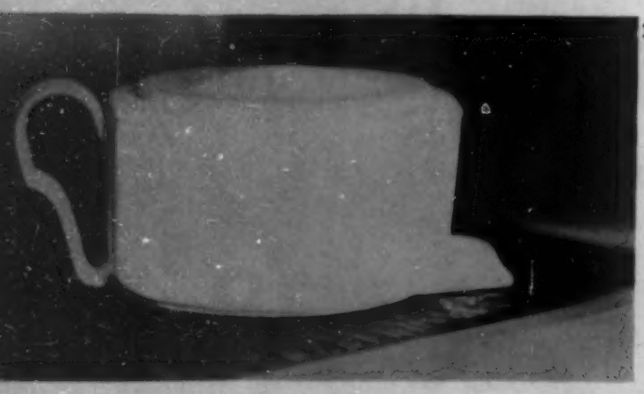
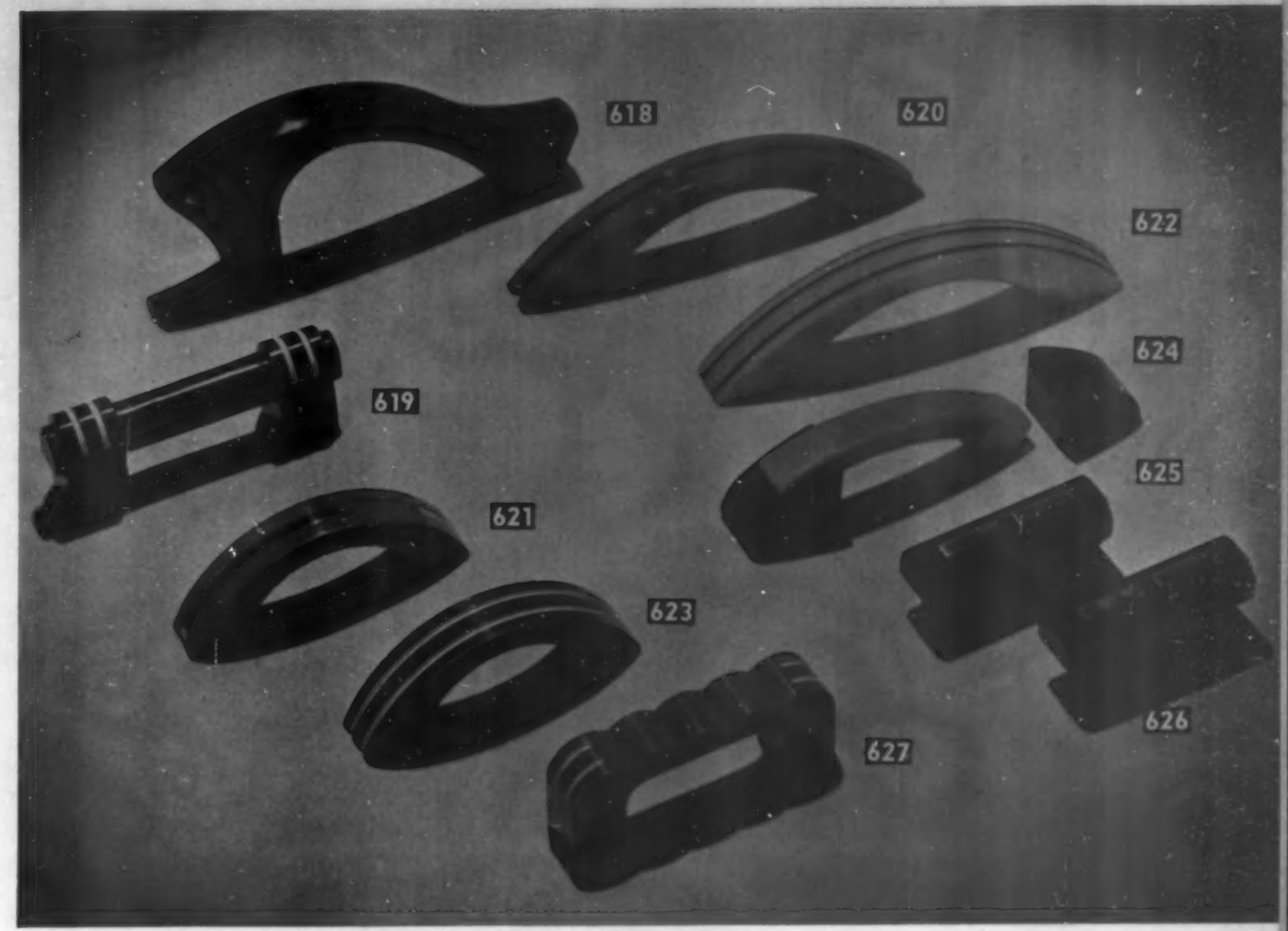
SEEN IN GERMANY

by PAUL GRODZINSKI



(1) CLOTH LINED CUTLERY CONTAINERS AND holders which fit neatly in silverware drawers keep silver in place and protect it from becoming scratched. Molded of phenolics, these holders fit small wooden blocks which are fastened to the drawer bottom. (2) A similar molding which holds dinner and dessert cutlery at the table provides a place card holder as well as a holder for small flowers with individual water compartment. Made by Gebr. Buchholz, Eberswalde near Berlin. (3) Flies won't like this molded sugar bowl but customers in restaurants will appreciate its hygienic and sanitary improvement over those in current use. Completely covered, it has an oval cross-section which supports the handle and spout. There is a division inside which, regardless of sugar level or pouring motion, delivers but one spoonful of sugar at a time. Molded in phenolic, urea and transparent resins, it is extremely popular. Made by Ewald Winzen, Köln-Braunsfeld, Germany. (4) Combined penholder and inkstand with molded black phenolic base and hollow ball of transparent phenolic resin in green and red. The ball is movable on the base, balanced on its own weight. Composed of two halves, it is cemented together and has only one aperture closed by a conical tube of the length of the semi-diameter of the ball. The ball can be filled up to $^1/_3$ its diameter with ink and, since the tube extending in the hollow part is $^1/_2$ of the diameter in length, it is impossible for the ink to escape. Manufactured by Franz Dittrich, Dresden-A., Dürerstr. 100, Germany. (5) This thumb-pressure oil can of transparent cellulose which makes the oil level visible at all times is manufactured by Becro-Werkzeugfabrik R. Belzer, Wuppertal-Cronenberg. (6) Small hardware for doors and windows is quite common in Germany. Those illustrated are of black phenolic, some in combination with metal. Produced by Grieshammer-Werke, Elsterwerda/Sachsen.



STOCK MOLDS

SHEET FIFTY-ONE

Molded handles have many uses, sometimes far removed from the original purpose for which they were made. These pictured may be obtained from stock molds and quantity quotations will be gladly sent to interested executives who write on business stationery. Even small quantities may be purchased with economy.

---

618. Coffee or tea pot handle 4 in. long. 1 7/8 in. high with two openings for easy attachment. 4 3/8 in. overall

619. Stove handle or drawer pull, 1 7/8 in. long, 1 1/4 in. high. Two openings for attaching

620. Oven handle with metal inlay, 4 3/4 in. long. Two threaded metal inserts

621. Same as 620, 3 in. long

622. Same as 620 with contrasting color wiped in for decoration

623. Same as 621 with contrasting color wiped in for decoration

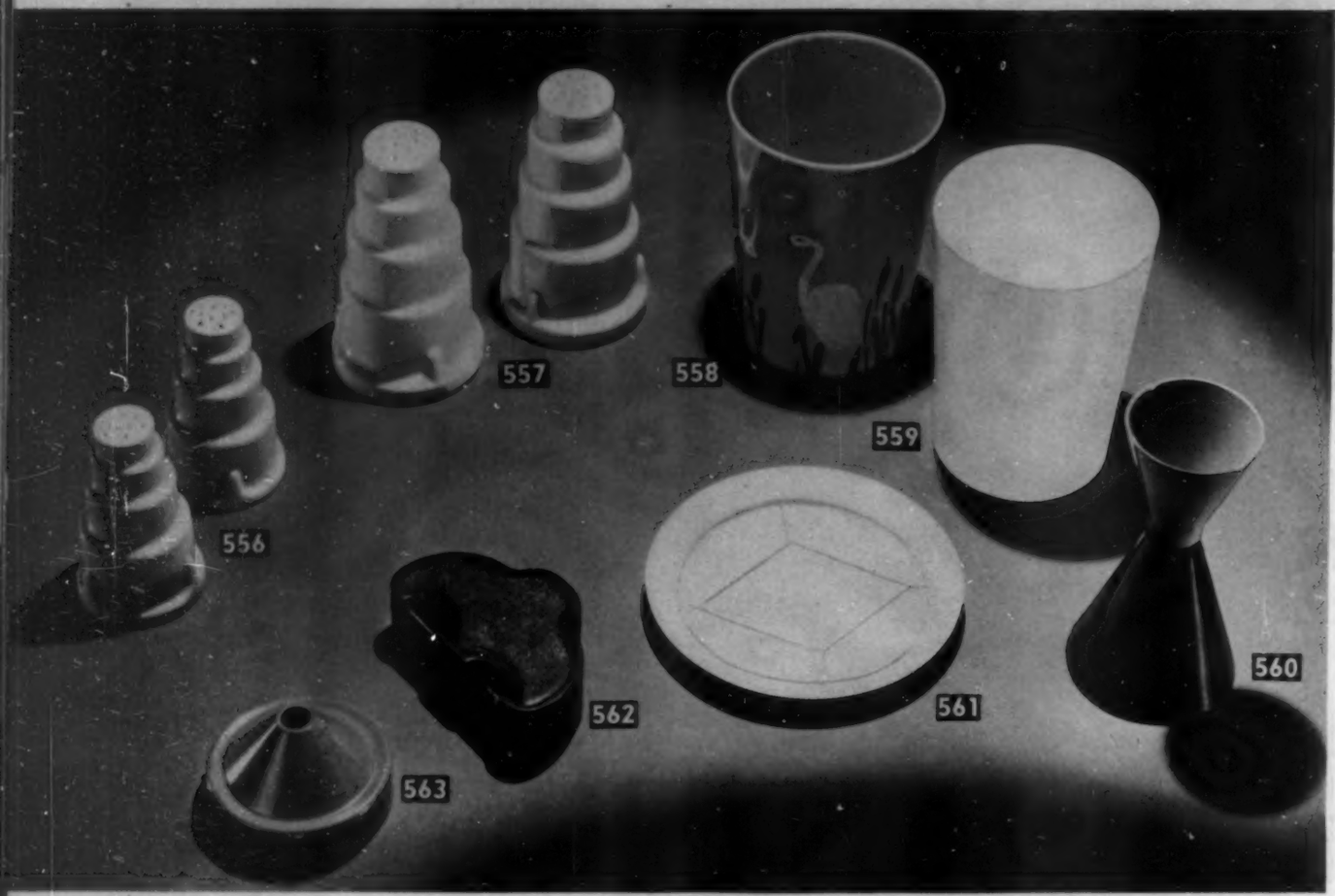
624. Three-piece handle 3 1/2 in. long by 1 1/8 in. high. Contrasting ends

625. Oblong knob-type with metal band and inlay. Threaded inserts for attaching

626. Handle 2 1/16 in. long with 1/2 in. stem and 3/8 in. opening for attaching

627. Handle 2 13/16 in. long, 1 in. high

Address all inquiries to Stock Mold Department, Modern Plastics, 425 Fourth Avenue, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits.



STOCK MOLDS

SHEET FIFTY-TWO

These items are available from stock molds. Inquirers should specify both sheet and item numbers when writing for samples. Please use business stationery.

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556. Table size salt and pepper shakers with removable bases for refilling. 1 1/4 in. in diameter, 2 1/2 in. high

557. Kitchen size pepper and salts 1 3/4 in. in diameter and 3 1/2 in. high

558. Standard 8 oz. molded tumbler hand painted 2 9/16 in. in diameter. 3 5/8 in. high

559. Same as 558, undecorated

560. Dual standard liquor measure—a poney or a jigger. 3 5/8 in. overall. Combination of dark and light plastic

561. Beveled suction-proof coaster or ash tray 3 3/4 in. in diameter

562. Picturescope, a device for viewing 16 mm. film

563. Dispenser cap threaded to fit 48 mm. bottle or jar for dispensing catsup, mustard, sugar and such

Address all inquiries to Stock Mold Department, Modern Plastics, 425 Fourth Avenue, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits.

PHENOL-FORMALDEHYDE RESIN AS A PLYWOOD ADHESIVE

by LAWRENCE E. STOUT* and WILLIAM B. BREW*

AN INVESTIGATION CARRIED OUT IN THIS LABORATORY[1] indicated the desirability of further research upon the utilization of phenol-formaldehyde resin in the bonding of plywood. The previous work which was confined to one wood, maple, has been extended to a number of species of wood commonly used in plywood.

A phenol-formaldehyde resin was prepared by heating the following reagents under reflux for 20 minutes: 100 parts by weight of phenol, U.S.P.; 90 parts by weight of 37 percent aqueous formaldehyde solution, U. S. P.; and 30 parts by weight of 12N ammonium hydroxide. At the end of this time the resinous product was visible as a thick viscous layer at the bottom of the container. The refluxed mixture was poured quickly into cold water and a solid resin separated.

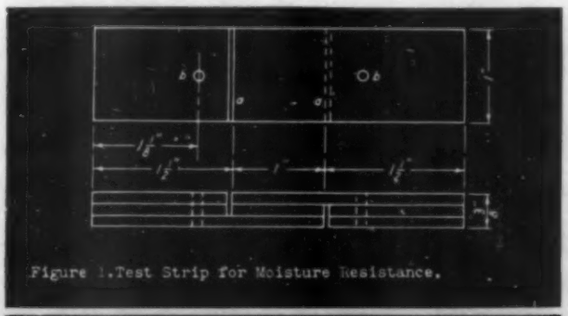

Figure 1. Test Strip for Moisture Resistance.

Figure 2. Shear Strength Testing Apparatus.

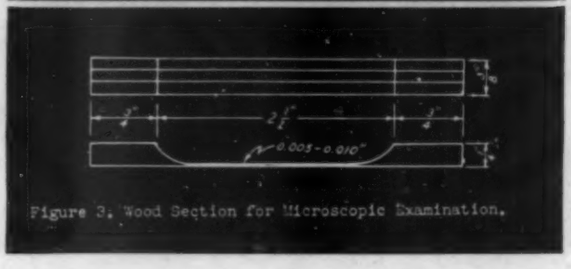

Figure 3. Wood Section for Microscopic Examination.

This resin was dissolved in acetone to produce a 20 percent solution by weight. This solution may be applied to the wood surfaces by spraying, brushing or dipping. Preliminary experiments indicated that each of these methods would produce good results, provided the same quantity of resin was used. In later experiments application by spraying was found the most satisfactory. The resin solution is applied to both surfaces taking part in the bond, 1 pound of resin per 10 square yards of wood surface was required for best results. The coated wood was dried twenty-four hours under normal conditions before hot pressing.

Several types of commercial plywood core stock, 1/8 inch thick were used for the tests. After application of the resin and drying, the wood was cut into 4 inch squares and assembled into 3 ply pieces with the grain of alternate plies at right angles. Bonding was accomplished in a 12 ton Elmes hydraulic press which was provided with electrically heated platens, pressure gage and a mercury thermometer for measuring temperatures of the platens. After bonding each sample was cooled and cut so as to supply three 1 by 4 inch test strips. These were used for shear strength and moisture tests.[2] These strips were cut from the central portion of the sample with the long dimension in the direction of the grain of the outer plies, Fig. 1, and with the cross cuts, a-a, as shown. All of the cutting was done on a small circular saw whose depth of cut could be regulated. After cutting, the 1/8 inch diameter holes, b-b, were drilled.

Strips to be tested for moisture resistance were then suspended by wires with a 4 ounce weight fastened at one end so that they were submerged entirely in boiling water. After a 4 hour period in this boiling water the

*Washington University

[1] Stout and Collins, Modern Plastics, 12 (10), 42 (1935).

[2] Traux, U. S. Dept. of Agriculture Tech. Bull. 205 (1930).

test strips were removed from the water and dried at normal room temperature for 48 hours. This drying set up a severe strain in the strips. After this period of drying a second 4 hour period in the boiling water was imposed and was followed again by a second 48 hour drying period. Samples which withstood these tests were then tested for shear strength.

Strips to be tested for dry shear strength as well as those strips surviving the boiling test were treated as follows: A longitudinal force was applied to the test strips by means of a suitable lever arrangement, Fig. 2. It can be seen, Fig. 1, that such a force will set up stresses in the glued surface, the test portion of which is one square inch in area. Hence the force imposed will be a measure of the strength in shear of one square inch of the glue line. The testing device, Fig. 2, consisted of a simple lever for applying the force, L, a suitable arrangement for clamping the test strips in place, C, and a means for applying the stress at a uniform rate, F.

In addition to these physical tests, an attempt was made to determine the nature of the plywood bond by means of a microscopic examination of thin sections under transmitted light. Work along this line has been done and Kraemer[3] claims that such an examination yields information as to the thickness and uniformity of the glue film, the penetration of the glue, and its chemical alteration. To secure samples suitable for examination and photographing it was necessary to devise a means of securing thin sections without affecting the bonding material or destroying the bond. The nature of the samples precluded dehydration and mounting in paraffin or collodion as is done usually with the preliminary sectioning of wood samples. The use of the microtome on unmounted plywood caused the thin sections to break at the glue line. To avoid these difficulties, a piece of plywood $^1/_2$ by 4 inches was cut with the outer grain in or parallel to the length, and treated as follows: The central portion was sanded down to a thickness of about $^1/_{16}$ inch, Fig. 3, and the back also sanded smooth. The front and back were then scraped down with a sharp glass edge used as a scraper, until the central portion had a uniform thickness such that it permitted the transmission of light. For a hard wood such as red gum, the thickness could be made less than 0.005 inch and for softer woods such as cottonwood, the final thickness was about 0.01 inch.

The wood samples were set up on the stage of a microscope and photographed under various magnifications

Table I. Data on the Bonding of Three Ply Maple at 350° F. (1 Pound Resin per 10 Sq. Yds.)

Bonding Conditions			
Time minutes	Pressure lbs./sq. in.	Dry Shear lbs./sq. in.	Wet Shear lbs./sq. in.
7	50	40	...
7	100	103	...
7	150	143	81
7	200	171	68
7	250	173	...
9	50	90	...
9	100	146	126
9	150	175	131
9	200	163	111
9	250	200	90
9	300	200	50
15	50	134	108
15	100	146	132
15	150	175	131
15	200	171	148
15	250	170	116
5	150	93	...
25	150	160	161
5	250	94	...
12	250	177	...
20	250	140	103

[3] Kraemer, Jahrbuch 1930 der Deutschen Versuchsanstalt fur Luftfahrt, 434 (1934).

Table II. Data on the Bonding of Three Ply Red Gum

Bonding Conditions				
Time minutes	Pressure lbs./sq. in.	Temp. °F.	Dry Shear lbs./sq. in.	Boiling Test hours: minutes
7	250	350	126	1:00
9	250	350	166	4:45
7	500	350	130	0:35
9	500	350	180	0:40
5	250	375	129	8:00
7	250	375	182	16:00
5	500	375	149	0:35
7	500	375	173	4:00

Table III. Data on the Bonding of Three Ply Cottonwood

Bonding Conditions					
Time minutes	Pressure lbs./sq. in.	Temp. °F.	Dry Shear lbs./sq. in.	Wet Shear lbs./sq. in.	Boiling Test Hrs.: Min.
7	150	325	108	...	....
12	150	325	190	67	....
5	150	350	81	...	....
7	150	350	157	...	4:10
7	250	350	191	...	4:10
7	350	350	149	...	0:40
7	500	350	202	...	0:20
9	150	350	185	114	
12	150	350	199	120	
15	150	350	180	126	
5	150	375	160	114	
7	150	375	166	120	
12	150	375	237	176	
15	150	375	193	140	
20	150	375	196	149	
4	150	400	209	132	
5	150	400	208	146	
7	150	400	225	190	
9	150	400	200	155	

Table IV. Optimum Bonding Conditions

Wood	Time minutes	Temp. °F.	Pressure lbs./sq. in.
Maple	5–8	375–400	150
Birch	6–8	375–400	150
Cottonwood	6–8	375–400	150
Red gum	7	375–400	250

Table V. Glue Line Data

Wood	Adhesive	Film Thickness (In.)		
		Minimum	Maximum	Average
Red gum	Casein glue	0.00094	0.00232	0.00145
Red gum	Sprayed resin	0.000196	0.00177	0.00098
Birch	Resin (dry film glue)	0.00142	0.00177	0.00153

TENITE lowers cost of pens

For the first time, pens with tapered decagon barrels are being sold at a popular price. Slow swedging of tubing has been eliminated – costly hand shaping is accurately copied by rapid injection molding of Tenite.

Thousands of these Tenite pens go into assembly daily – in a few seconds the thin walls are threaded...turned...drilled...beveled... punched. Few materials would stand this test of workability without shattering.

Tenite has helped place many useful articles on "popular price" counters – unsurpassed strength and speed of molding make it a basic industrial material.

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Tenite is a tough, practically unbreakable plastic made of Eastman cellulose acetate in an unlimited range of transparent and opaque colors. Leading custom molders will tell you more about its advantages, or write us direct for a copy of a 52-page book on Tenite and its uses.

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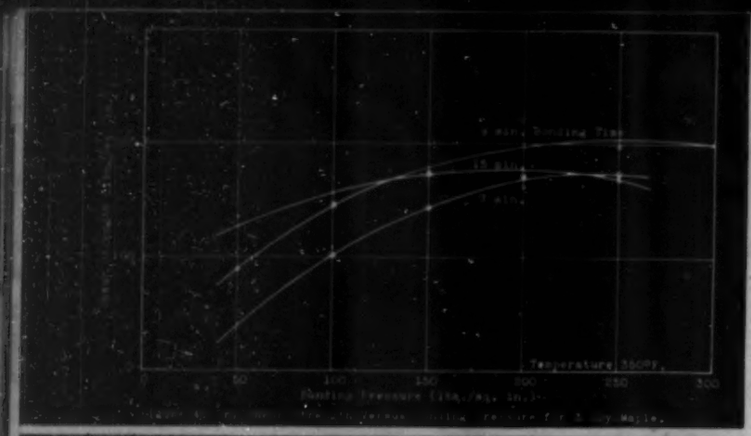
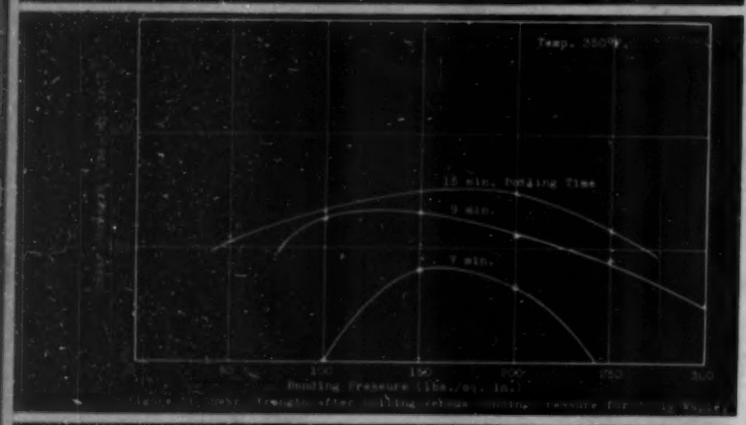
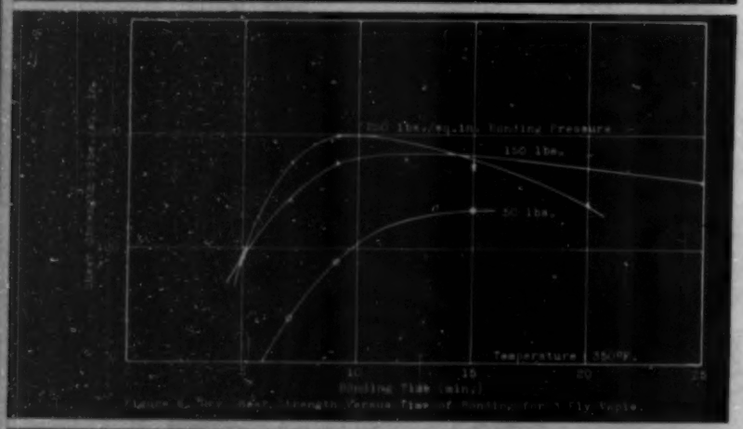
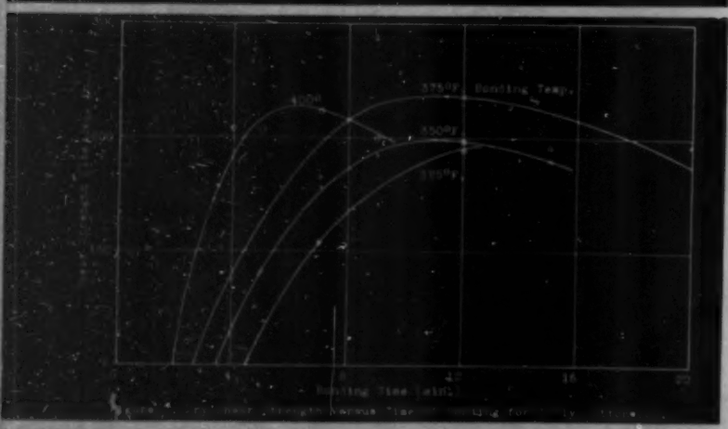
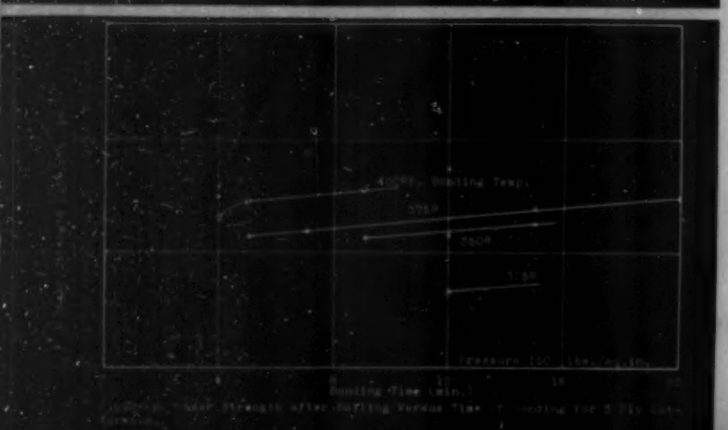










using a Wratten A red filter and Cramer Spectrum Process Plates. Measurements were made on the photographs to determine the variation in thickness of several types of glue films.

The results obtained are presented in tables I to V and Figs. 4 to 8. The wood used in all tests was commercial core stock which was not specially selected as to grain or curing. This resulted in low shear strength values which varied rather widely. However, they are representative of values which would be obtained from such commercial products. The apparatus used in testing the shear strength of the wood was designed primarily for comparative tests and the stresses produced by it were not purely in shear. Bending stresses inherent to the apparatus tended to reduce the values of the shear strength obtained.

The usual test for the resistance of plywood to moisture consists of a period of soaking in cold water.[4] For the purpose of this experiment, it seemed desirable to impose a more severe test. It was desired that the test should depend more for its results upon the resistance of the bond to boiling than its shear strength after soaking.

Figs. 6 and 7 show the effect of varying the length of bonding time upon the dry shear strength of plywood for various constant pressure and temperature conditions. It was found that the normal type of curve consisted of: first, a period of insufficient bonding time, second, a period during which the shear strength value rose to a maximum value and, finally, a period of slowly decreasing strength values which apparently result from overcuring the resin. The resistance of some of the same bonds to moisture, Fig. 8, shows that once the moisture resistance has been built up to the point where it is able to withstand the boiling test, further bonding produces a gradual rise in the shear strength. This rise is small, however, and it would be impractical to sacrifice the dry strength for a slight gain in moisture resistance. This is also true because of the fact that the bonding expense would be greater.

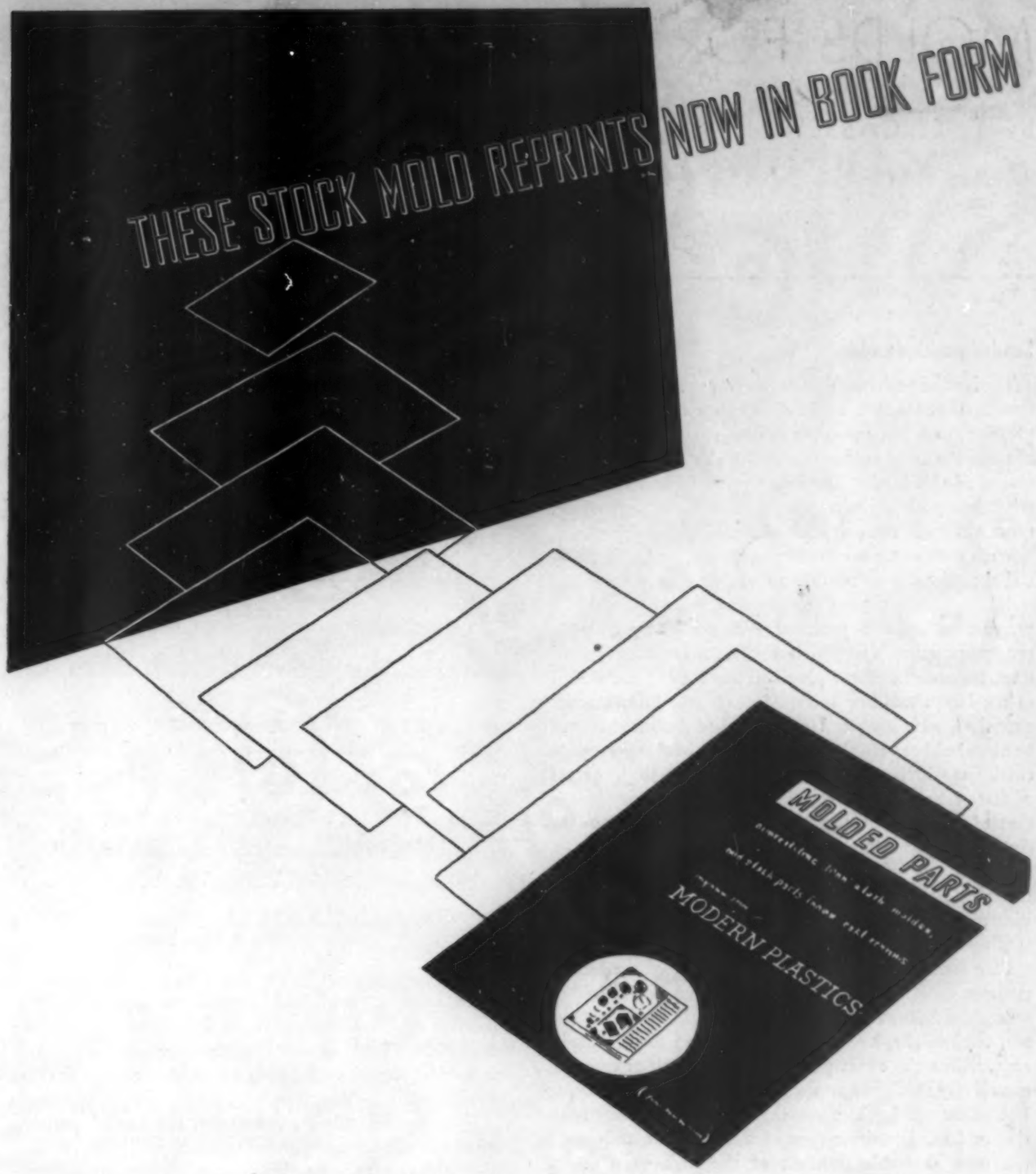
As the temperature was raised the time required to produce maximum shear strength of the dry bond was lessened (Fig. 7). Within the temperature range 350–400°F. little variation was found in the maximum strength value. The time necessary to produce a moisture resistant bond (Fig. 8), is not only lowered by increased temperature but also the shear strength of the samples passing the boiling test is increased. The limiting temperature is 400°F. at which temperature the wood begins to scorch or char slightly on the surface.

The effect of varying the pressure on the dry shear strength of plywood (Fig. 4), is to raise the strength from low values at low pressures of 50 pounds per square inch or less, to higher values at higher pressures. These values approach a maximum value at pressures just below the elastic limit of the wood and remain constant or decrease slightly for pressures moderately in excess of this value.

In the case of moisture resistance, the effect of pressure is more marked. The initial (*Please turn to page 68*)

[4] Traux, see reference 2.

THESE STOCK MOLD REPRINTS NOW IN BOOK FORM



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MODERN PLASTICS

425 Fourth Avenue, New York, N. Y.

MOLDS FOR PHENOL RESINOIDS

by T. E. CASSEY*

Fifth installment continued from our February issue and reprinted by permission from August 1937 issue Journal of The American Society of Naval Engineers

Landed positive molds

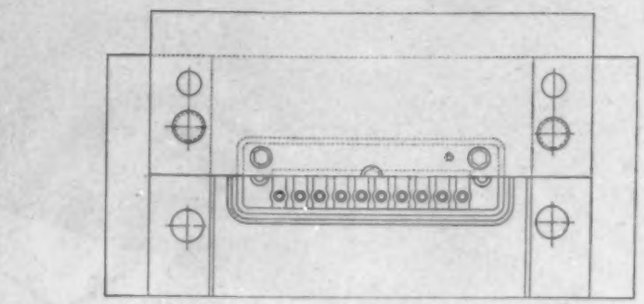
The landed positive mold differs from the truly positive type in that there is a "land" or shoulder in the compression space just above the molding cavity. This type of mold insures a uniform height of the molded piece by reason of this land. The landed type of mold is somewhat less positive in its action than the truly positive type, although the principle of trapping is retained.

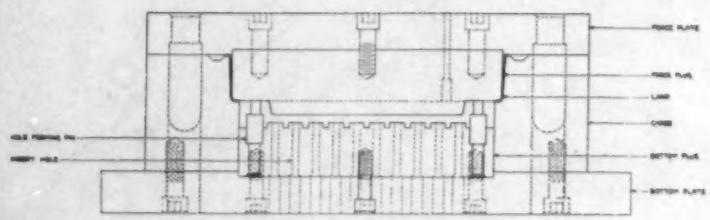
With sufficient material in the charge, and it is essential that the charge contain an adequate amount of material to produce parts of the proper density, the molding pressure is applied positively to the charge. With proper operation, a fin which may be easily removed, will form between the force plug and the land. The width of the land should be about $\frac{1}{8}$ inch and should never exceed $\frac{3}{8}$ inch in order that the applied pressure will not be absorbed between the charge and the land and produce thick fins which are difficult to remove. A slight excess of material is permissible, provided sufficient pressure is exerted. This will tend toward a slight increase in density of the finished part.

In this type of mold, the piece is ejected toward the top face (either by constructing the bottom as a separate piece, or by the use of ejector pins), in order to avoid scoring the peripheral surface of the mold.

Care must be exercised in the selection of the landed position mold for materials which do not flow freely or where the filler material (cloth, fabric, long-fiber asbestos, etc.) might, by premature curing on the "landed" area, reduce the direct pressure on the work or result in excessively thick fins on the finished part at the dividing line of the mold. The selection between the truly positive or landed positive type of mold also depends upon the most desirable position of the flash—vertical or horizontal—and upon the resultant cleaning operation. The shape of the piece and the position in which the piece is molded will enter into the decision as to the preferred type. Usually the manufacturer will be requested to submit his reasons for the use of the landed positive type of mold, when proposed, for the particular item that may be in question.

Fig. 8 shows the design and arrangement of a Landed Positive Mold; Built-Up Construction, Indirect Heated, Hand, Single Cavity, Complete Closure, Knock-out Plate Ejecting. The construction of this type of





BUILT UP CONSTRUCTION INDIRECT HEATED HAND, SINGLE CAVITY, LANDED POSITIVE, COMPLETE CLOSURE KNOCKOUT PLATE EJECTING MOLD

FIG VIII

mold, except for the "land" is much the same as the truly positive type and needs no detail description. The location of the "land" is well illustrated by this sketch, and it will be seen that the flash found in the piece will be horizontal in its direction.

Next to the truly positive type, the landed positive mold has the most numerous applications in the production of Navy Design molded pieces. There are approximately 25 single cavity molds and 20 multiple cavity molds of this type in active use. Of the group of single cavity molds, all but one are of the hand classification. The one semi-automatic mold mentioned will undoubtedly revert to hand type in event of a replacement mold being purchased.

The group of landed positive multiple cavity molds has quite a considerable variation of cavity arrangements running from 2-cavity to 12-cavity. The 4-cavity arrangement predominates and is believed to be the most satisfactory set-up for Navy molds. Seven molds of this group are semi-automatic, and the applications in these

* Chief Electrical Draftsman of the Bureau of Engineering, Navy Dept.

American Flexible Connectors
IN MODERN PLASTICS MOLDING PLANT

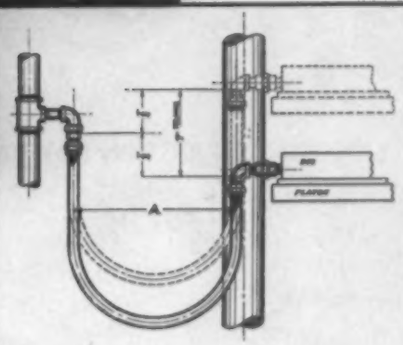
American Seamless *Flexible Bronze Tubing installed on special high speed molding presses at General Electric's new plant in Pittsfield, Massachusetts.*

THE General Electric system of heating the molds calls for flexible tubing to convey water at 370° F. under 200 pounds pressure...which must be maintained with an even, smooth flow at all times. That's why over 1,000 assemblies of American *Seamless* Flexible Bronze Tubing and couplings have been installed in G. E.'s plastics molding plant at Pittsfield, Mass., where they are giving highly efficient service.

Regardless of the kind of heating medium conveyed to the molds or platens...hot water or steam...or alternating between steam and cold water...American Flexible Metal Tubing has no rival. It is as leakproof as the *seamless tubes* from which it is made.

Available in several metals...principal of which is bronze ...American Seamless is easily installed and can be quickly changed from one mold to another.

Write for our 20-page booklet which shows typical installations and presents engineering data on this modern, *leakproof* tubing. Ask for Bulletin SS-3. It is free of charge.



This illustration shows a vertical installation of American *Seamless* Flexible Metal Tubing on plastics molding presses ... a popular method, used in G. E.'s Pittsfield plant. (See photograph above.) Where steam is piped to the dies rather than to the platens, and where the steam pressure is high enough to eliminate the possibilities of water pockets forming, this installation method is ideal. A table in our Bulletin SS-3 will aid you in determining the overall length of any assembly needed.

If you are contemplating any special installations, our highly trained Technical Department with a 30-year background of experience will be pleased to help in solving your problem.

ANACONDA

THE AMERICAN BRASS COMPANY

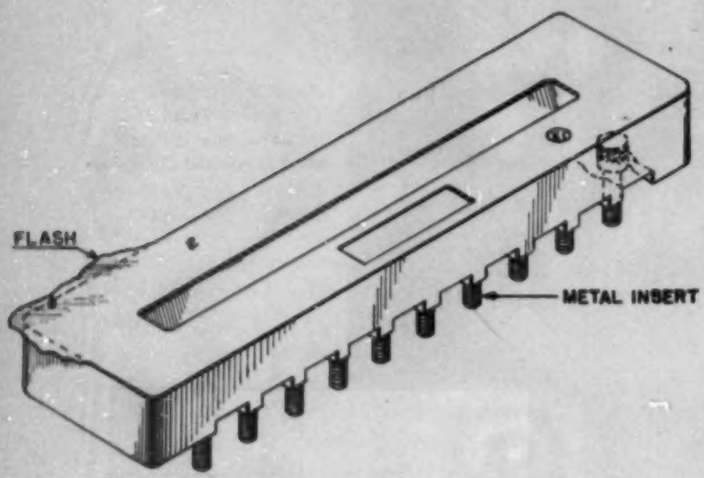
American Metal Hose Branch

General Offices: WATERBURY, CONNECTICUT

cases appear satisfactory. These are the only cases, however, where the use of semi-automatic molds for Navy work is found justifiable.

Weights of the landed positive type of molds are comparable with the weights of similar truly positive molds.

Fig. 9 shows a design of molded piece found suitable for production from a landed positive type of mold.



MOLDED CONNECTION BOX BASE

FIG. IX.

Semi-positive molds

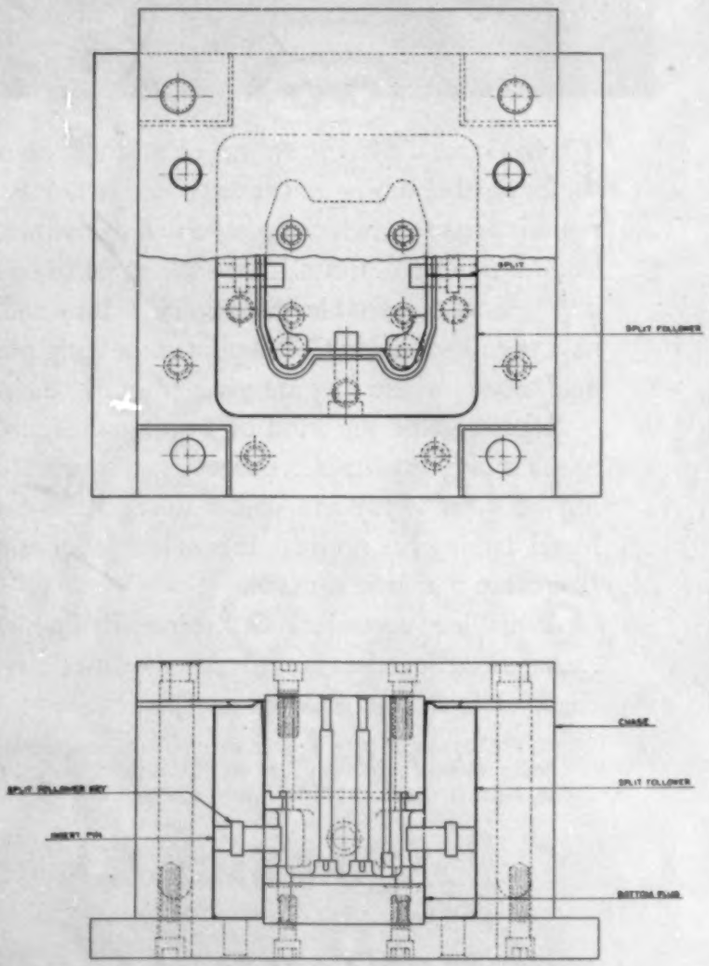
The semi-positive mold is a composite type, combining the features of the positive and flash molds. This type of mold is even less positive in its action than the truly or landed types. It operates as a flash mold within a short distance of final closure, when, at this point, the force plug telescopes within the chase just a sufficient distance to exert a positive pressure on the charge during the final closure of the mold. Compared to the positive and landed positive types, the total mold height is much less, due to the short force plug. In some types of semi-positive molds, in addition to the flash surface at the top, a slight clearance between the force plug and the lower die is provided which permits excess material to escape, forming a thin vertical fin.

If no clearance is provided between the lower die and the force plug, the mold operates as a landed positive mold during the last fraction of an inch ($^1/_{32}$ inch to $^1/_8$ inch) of travel. When clearance is provided, by proper proportioning of parts, the thickness of the vertical fin may be determined, and is independent of the thickness of the flash, which is advantageous in multiple-cavity molds. Extreme care must be exercised in this type of mold that the clearance between the lower die and the plunger is not too great, otherwise the mold becomes a flash mold, the advantages of a semi-positive mold are lost and the extra construction is wasted.

The semi-positive type may also be of the stripper-plate type. This type of mold is well adapted for molding from tabletted or preformed material and using multiple-cavity molds, and may be successfully employed with the more plastic of the molding materials and for parts of simple shape and small size. Its use may provide good economy under some circumstances, provided its inherent limitations are understood and given due consideration.

The Navy has four applications of semi-positive molds all of which molds are designed for the production of boxes of high impact material. These molds are single cavity hand type and are fitted with filler plates and also use spacer forks. The force plug of these molds telescopes with the cavity only a distance of $^1/_{16}$ inch, which represents the distance that the feet of the boxes molded extend below the bottom surface of the box.

These molds represent a particular development for the group of boxes concerned, where the boxes are molded "bottom up" and where a particular type of high impact material was used. The reason back of the development was sound, which was to avoid the use of long insert holding pins with high impact material. From a weight and cost standpoint the molds were an attractive proposition and thus operation under the conditions designed for was satisfactory. Due to (*Please turn to page 66*)



BUILT UP CONSTRUCTION (SPLIT FOLLOWER) INDIRECT HEATED, HAND, SINGLE CAVITY, TRULY POSITIVE, COMPLETE CLOSURE, KNOCKOUT PLATE EJECTING MOLD.

FIG. X

HANDLES of DURITE

For molded handles and numerous equally distinctive applications, Durite is selected by engineers and designers to meet the most rigorous specifications on electrical and mechanical strength, resistance to moisture, shock, heat and wear.

Investigate plastics by Durite, the exclusive producers of phenol-furfural resins.

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PLASTICS DIGEST

This digest includes each month the more important articles (wherever published) which are of interest to those who make plastic materials or use them

General

PRESENT STATUS OF SYNTHETIC RESINS IN THE ELECTRICAL FIELD. L. E. Barringer. General Electric Review *40*, 354–7 (Dec. 1937). At this time the most important resins to the electrical industry are the phenolic and alkyd resins, with special applications for urea, vinyl, acrylate, polystyrene, and aniline resins in practically the same order of importance as that in which they are named. The phenol resins predominate in molded and laminated applications and the alkyd resins in insulating and protective coatings. The other resins are finding their way into branches of the electrical industry not occupied by previously developed resins, such as in wire and cable manufacture.

THE ECONOMICS OF THE PLASTICS INDUSTRY. H. V. Potter. Chem. and Ind. (London) *57*, 81–3 (Jan. 22, 1938). A discussion of availability of raw materials and annual turnover of finished products in the British plastics industry. The speaker compared the "plastic mindedness" of Great Britain, the United States, and Germany on the basis of total weight of plastics manufactured divided by the population. The "plastic mindedness" of Great Britain is 1.09, U.S.A. 1.45, and Germany 1.5.

RAW MATERIALS OF THE PLASTICS INDUSTRY. G. J. Esselen and F. S. Bacon. Ind. and Eng. Chem. *30*, 125–130 (Feb. 1938). See abstract of this paper in Sept. 1937 issue of MODERN PLASTICS, page 58.

Materials and manufacture

GENERAL PROPERTIES OF CELLULOSE DERIVATIVES. R. Bluma. Rev. Gén. Mat. Plastiques *13*, 332–40 (Nov. 1937). Tests on moisture absorption by cellulose nitrate films prepared in different solvents gave the following results:

Solvent	Moisture absorbed (%)	
	72 hrs.	144 hrs.
Methanol	5.23	5.62
Ethyl formate	2.59	4.84
Methyl acetate	1.42	3.51
Ethyl acetate	2.95	3.01
Acetone	3.41	4.88

Films prepared from the solvents most soluble in water take up the most moisture. As the solvents were driven off by heating at 100° C. for 48 hours, they must leave a special structure which causes the sensitivity to moisture to vary. Choice of solvents should not, therefore, be made on price alone, but on the properties desired in the finished product. Mixed solvents were not investigated. Acetone gave the films with the best mechanical properties of the single solvents studied which included the above and ethyl alcohol. Plasticizers are to be considered in a later issue.

POROUS CELLULOSE ACETATE PLASTICS. J. F. Benjamin. Rev. Gén. Mat. Plastiques Suppl. *13*, 321–3 (Nov. 1937). Various methods for the preparation of porous cellulose acetate plastics are described. The density of the product is cited as 0.09, compared with wood 0.8, felt 0.14, asbestos paper 1.1, and cork 0.2. Suggested uses for the material are as thermal insulation and as a packing in life saving belts.

PREPARATION OF VINYL ACETATE FROM PARALDEHYDE. M. Jeanny. Rev. Gén. Mat. Plastiques *13*, 325–8 (Nov. 1937). Paraldehyde furnishes an alternative material to the explosive acetylene for the manufacture of vinyl acetate. The acetaldehyde formed from the paraldehyde reacts under the influence of acids as the enol (CH_2—CHOH) and combines with acetic acid to yield vinyl acetate. Acetic anhydride must be used to take care of the water liberated during the reaction.

STYRENE AND ITS POLYMERS. H. M. Stanley. Chem. and Ind. (London) *57*, 93–8 (Jan. 29, 1938). Experimental results on various polymerization processes are reported.

Molding and fabricating

IMPROVEMENTS IN MACHINING METHODS FOR PLASTIC MATERIALS. British Plastics *9*, 402–4 (Jan. 1938). Nitrided high speed drills give longer service than the common variety. An alternative way to increase tap life is to chromium plate them. Marked improvements in cutting operations have been accomplished by replacing the saw with an abrasive wheel which travels through a fixed piece. Several sheets can be machined at one time, yielding true and well-finished edges which do not require further treatment.

DEVELOPMENTS IN PLASTIC MOLDING EQUIPMENT. L. F. Rahm. Mech. Eng. *60*, 117–22 (Feb. 1938).

ELECTRO-PLATED MOLDINGS. Plastics (London) *1*, 12–14 (Jan. 1938). Where a lightweight part with a metallic finish is desired, a new electroplating process is available which permits platings of copper, brass, nickel, chromium, and silver on plastics. Rhodium, which has the beautiful sheen of silver but is non-tarnishing, is now included in the list of metals capable of being deposited.

Applications

TELEVISION MAKES GOOD. Plastics (London) *1*, 4–5 (Jan. 1938). In 1936 there were no television receivers in London; today there are 9,000 and the number is increasing daily. So far little has been done in the utilization of plastics for the housings, but plastics are found to be particularly valuable for the manufacture of the component parts subjected to the high voltages employed in television.

RECENT DEVELOPMENTS IN HOT PRESSING OF PLYWOOD. E. H. Merritt. Mech. Eng. *60*, 133–4 + (Feb. 1938). Hot-press equipment, hot-press processes, and hot-plate adhesives are discussed. A resin bond has no rival in its own field. Competition lies between non-resinous adhesives for hot pressing and cold gluing, and between the processes themselves.

PRODUCTION AND USE OF RUBBER PRINTING PLATES. J. F. Frey. Rubber Age *42*, 183–5 (Dec. 1937). Directions for preparing plates from rubber, neoprene, and polysulfide plastics are given.

NEW CEMENTS AND CEMENTING PROCESSES. E. Morath. Kunststoffe *28*, 11–14 (Jan. 1938). A review of industrial adhesives, including proteins, starches, gums, natural resins, rubber, cellulose derivatives, synthetic resins, and sulfite liquor by-products.

Testing

MEASUREMENT OF EXPANSION OF PLASTICS. T. Gast and H. Klingelhoffer. Kunststoffe *28*, 9–10 (Jan. 1938). An optical method of measuring dimensional change is described. Results of measurements with a wood-flour-filled phenolic composition are cited.

OPTICAL EXAMINATION OF SYNTHETIC RESIN PLASTICS. W. Weigel. Kunststoffe *28*, 5–8 (Jan. 1938). Notes on the preparation of thin specimens of molded and laminated plastics, and their examination by transmitted and reflected light in order to study the structure and distribution of fillers in the fabricated product.

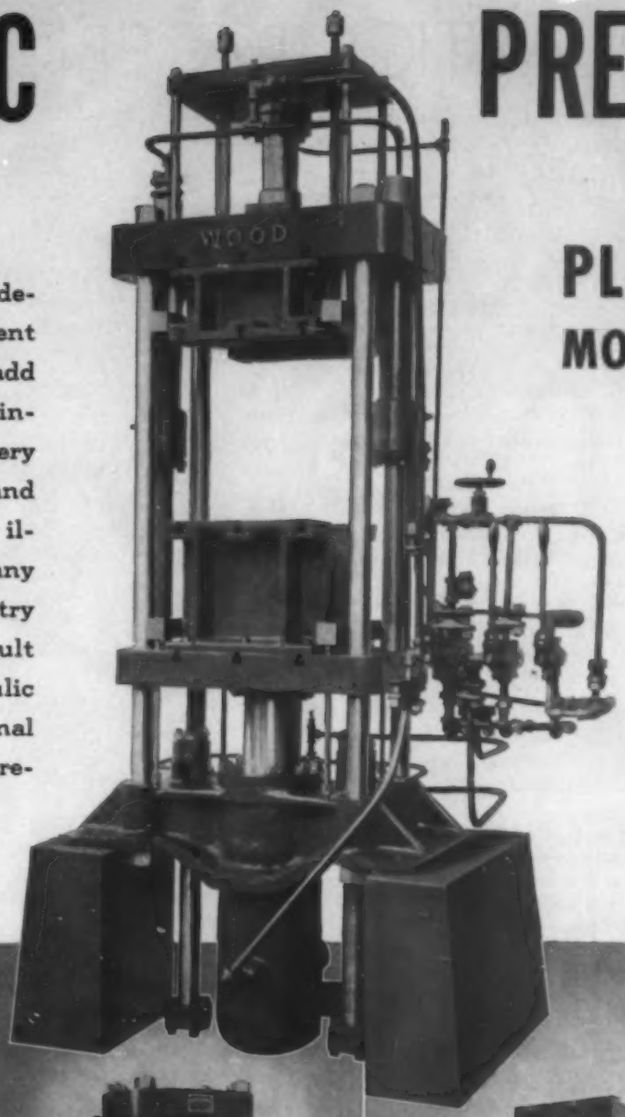
Synthetic coatings

RECENT EUROPEAN DEVELOPMENTS IN THE MANUFACTURE OF SYNTHETIC RESINS. Henry Pincass. Paint and Varnish Prod. Mgr. *18*, 48 + (Feb. 1938). A review concerning cumaron, phenol-formaldehyde, and urea-formaldehyde resins.

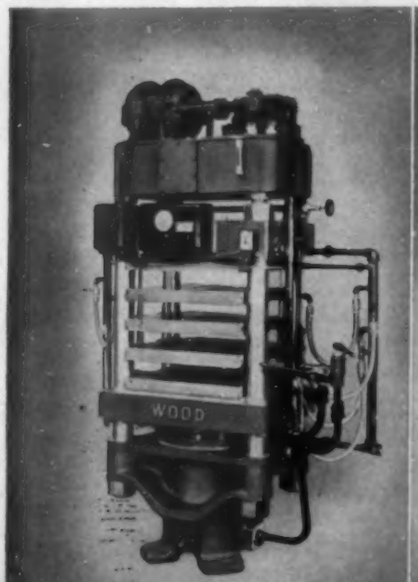
SOUND FOUNDATIONS. John McE. Sanderson. Paint and Varnish Prod. Mgr. *18*, 52–4 + (Feb. 1938). A discussion of the properties and uses of proprietary urea-formaldehyde and alkyd resins in protective coatings. The problem of replacing China wood oil with linseed oil combined with quick-drying, water-resistant synthetic resins or with cellulose nitrate lacquers fortified with synthetic resins is considered.

HYDRAULIC PRESSES FOR PLASTIC MOULDING

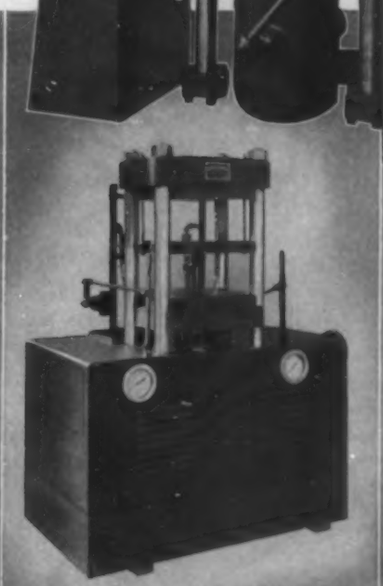
To R. D. Wood experience in designing hydraulic press equipment for the Plastics Industry, add manufacturing facilities which include special, modern machinery for producing Steam Platen and Moulding Presses. The presses illustrated are but few of the many produced for the Plastics Industry by R. D. Wood Company. Consult with our engineers about hydraulic presses of any size, involving normal or unusual production requirements.



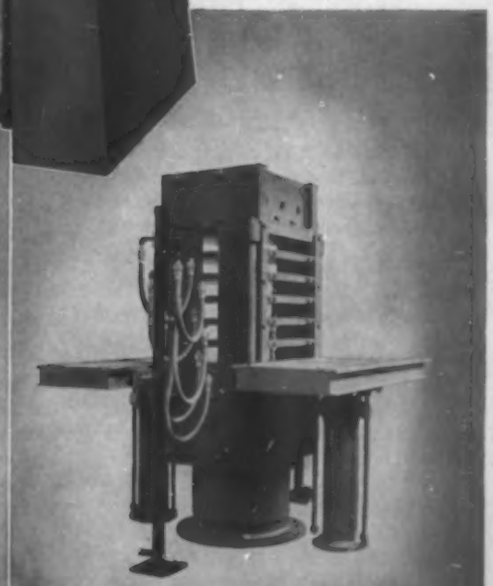
Semi-Automatic Moulding Press with Hydraulic Strippers



HydroLectric Four-Opening Steam Platen Press



HydroLectric Two-Opening Laboratory Press



Six-Opening, Solid Side, Steam Platen Press with Elevators

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U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

LAMINATED PAPER. J. A. Kenney (Barrett Co.). U. S. 2,104,081, Jan. 4. Compounding paper pulp with a dispersion of hard coumarone-indene resin, forming the pulp into paper and making laminated products therefrom.

FILM. O. Röhm and W. Bauer (to Röhm and Haas Co.). U. S. 2,104,168, Jan. 4. A film formed by interpolymerizing methyl acrylate and vinyl acetate is plasticized with amyl phthalate and methyl glycol phthalate.

PLASTER FINISH. Wm. L. Pringle (to U. S. Gypsum Co.). U. S. 2,104,240, Jan. 4. A protective coating system for plaster comprises a casein paint undercoater and nitrocellulose lacquer finish coat.

WATER PURIFICATION. B. A. Adams and E. L. Holmes. U. S. 2,104,501, Jan. 4. A phenol-formaldehyde resin in which a polyhydric phenol is the phenolic component is used in water purification by absorption.

RESIN. A. Renfrew (to Imperial Chemical Industries, Ltd.). U. S. 2,104,760, Jan. 11. Controlling the polymerization of methyl methacrylate by adding a catalyst and an inhibitor of polymerization, in proportions suited to the desired effect.

COLORED RESIN. Wm. H. Carmody. U. S. 2,104,829, Jan. 11. Tinting a cyclopentadiene resin by treatment with an aldehyde or ketone and an alkaline catalyst to develop the fulvene color structure in the resin molecule.

NITROCELLULOSE SOLUTIONS. K. Thinius (to Deutsche Celluloid-Fabrik). U. S. 2,104,957, Jan. 11. Effecting viscosity reduction, clarification and stabilization in nitrocellulose solutions by heating undissolved nitrocellulose with water under pressure at 106–150° C. while oxidizing the resulting volatile products.

ARTIFICIAL WOOD. G. J. Esselen (to A. S. Boyle Co.). U. S. 2,105,111, Jan. 11. A non-shrinking plastic substitute for wood is made of a cellulose derivative, wood flour, a solvent liquid and a non-solvent liquid in such proportions as to harden in air.

NITROCELLULOSE EMULSIONS. M. C. Moore (to Hercules Powder Co.). U. S. 2,105,155, Jan. 11. Use of methyl cellulose and a sodium salt of a sulfated long chain alcohol as emulsifying agents in nitrocellulose emulsions.

NONYELLOWING RESIN. Maurice Belloc (to Societe Nobel Francaise). U. S. 2,105,208, Jan. 11. Yellowing of resins made from polyvinyl alcohol by aldehyde condensation is prevented by adding a polyhydric phenol to serve as an antioxidant.

BLOOD IN RESINS. A. A. Robinson (to Wilson and Co., Inc.). U. S. 2,105,268 and 2,105,269, Jan. 11. Soluble blood is blended with a synthetic resin for use in making tough, flexible, waterproof laminated resin-and-fabric products, or molding powders.

COATED TUBES. John P. Smith (to Visking Corp.). U. S. 2,105,273, Jan. 11. Impregnating and coating tubular material with a cellulose derivative by applying the coating and then passing the tube through a precipitating bath.

INSULATED WIRE. P. Nowak; P. Nowak and H. Hofmeier, P. Nowak (to General Electric Co.). U. S. 2,105,361, 2,105,362, 2,105,363 and 2,105,364, Jan. 11. An oilproof, waterproof, ozone-resisting rubber-like polyacrylate resin for insulating electrical conductors is made by polymerizing acrylic acid and ethyl acrylate in presence of sulfur or selenium and compounding the product with carbon black.

VISCOSE SPONGE. Joseph Speijer. U. S. 2,105,380, Jan. 11. In making viscose sponge excess carbon disulphide is used in preparing the viscose, so that premature coagulation during the pore-forming operation is prevented.

KETENE RESINS. A. B. Boese, Jr. (to Carbide & Carbon Chemicals Corp.). U. S. 2,105,461, Jan. 18. Resins are made by condensing diketene with paraformaldehyde and vaporizing the volatile constituents from the system.

ADHESIVE. A. D. Macdonald (to B. B. Chemical Co.). U. S. 2,105,697, Jan. 18. Polymerized haloprene is dissolved in a cyclic ether of a glycol to make adhesives or coatings.

GOLF BALL COVER. A. D. Macdonald (to B. B. Chemical Co.). U. S. 2,105,746, Jan. 18. A polymerized chloroprene cover is applied to a rubber thread core from a solution which does not attack the rubber and the assemblage is molded.

SOUND INSULATION. R. D. Snow and H. J. Hepp (to Phillips Petroleum Co.). U. S. 2,105,511, Jan. 18. Making a light, porous resinous olefin-sulfur dioxide polymer for use in heat and sound insulation.

CABLE JOINTS. John K. Webb (to International Standard Electric Corp.). U. S. 2,105,567, Jan. 18. Insulating joints of oil impregnated paper insulated high tension cables with a mixture of polystyrene resin and a chlorinated aromatic hydrocarbon.

PLASTICIZERS. Wm. H. Moss (to Celanese Corp. of America). U. S. 2,105,952, Jan. 18. Glycol or glycerol esters of aryl-substituted aliphatic acids as plasticizers for cellulose esters or for vinyl resins.

FLEXIBLE SHEET. W. D. Bowlby (to Egyptian Lacquer Mfg. Co.). U. S. 2,106,164, Jan. 25. Coating a flexible sheet with a flexible nitrostarch lacquer containing at least 20% plasticizer.

ANATOMICAL SPECIMENS. John A. Weidemann. U. S. 2,106,261, Jan. 25. Preserving anatomical specimens by impregnating the dehydrated dead (human or animal) tissue with a mass of transparent dry lacquer.

FOILS. C. Dreyfus and G. Schneider (to Celanese Corp. of America). U. S. 2,106,296, Jan. 25. Transparent foils with high tensile strength and elongation are made from a low-acyl cellulose ester, diethylene gylcol and glycerol.

PHENOL RESIN. H. A. Bruson and L. W. Covert (to Röhm & Haas Co.). U. S. 2,106,452, Jan. 25. Thermal resinification of a diphenylolmethane or diphenylolpropane derivative by fusing, below the critical cracking temperature, until the crystalline character disappears.

ANION EXCHANGE REAGENTS. W. H. Kirkpatrick (to National Aluminate Corp.). U. S. 2,106,486, Jan. 25. Resinous m-phenylenediamine : formaldehyde condensation products, in gel form, are used for anion exchange reactions.

COATINGS. Achille Conzetti (to J. R. Geigy A.-G.). U. S. 2,106,518 and 2,106,519, Jan. 25. Dyeing cellulose ester lacquers (blended or not with synthetic or natural resins) with triarylmethane or azo dyes which are treated with an acetate of iron, copper, cobalt or nickel.

MODIFIED ALKYDS. C. Ellis (to Ellis-Foster Co.). U. S. 2,106,522 and 2,106,523, Jan. 25. Use of triethanolamine as the polyhydric alcohol in drying oil modified alkyd resins; and making alkyd resins in presence of urea and a fatty oil.

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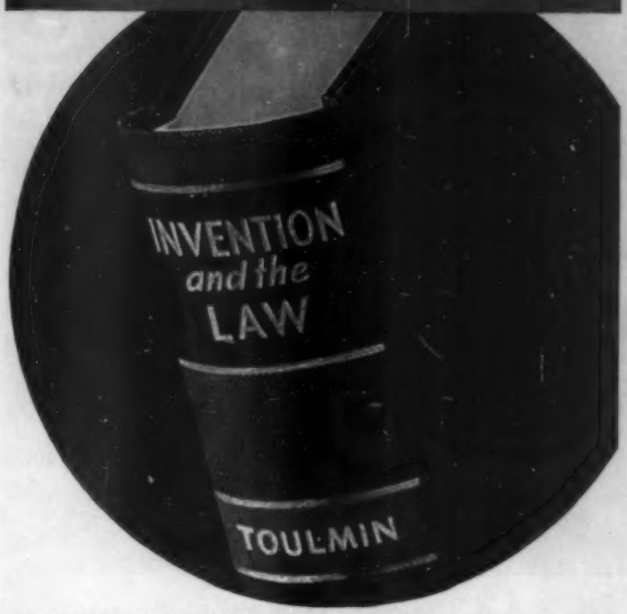

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(Photo) Attleboro molds this 1938 Emerson Cabinet . . . along with dozens of other leading sellers in the radio world.

In the still infant field of plastics, few molders have the reputation for dependability and resourcefulness of Associated Attleboro Mfgrs. Plastic users everywhere appreciate and rely upon our tradition for thoroughness and highest quality workmanship, our "flair for the mold" (coupled with a dogged persistence in seeing through a difficult job) and our ability to figure costs "right."

A plain policy—ingrained in the stock of the men who head Attleboro, and made potent by Attleboro's large resources in ingenuity, capital, and fine equipment—but also the big reason leading plastic users bring to us their difficult housing jobs or their intricate inserts, and close tolerances, knowing that Associated Attleboro furnishes them with a plastic product of consummate precision, attractiveness, and durability.

ASSOCIATED ATTLEBORO MANUFACTURERS, INC.
Attleboro Mass.

NEWS

THE DRAMATIC STORY OF THE DEVELOPMENT of an idea into a material and the development of a material into a great industry is being vividly presented at the Museum of Science & Industry, Rockefeller Center, New York, until March 31st. On view is a reproduction of a corner in the little laboratory in Yonkers, New York, where, in 1907, Dr. Baekeland developed Bakelite Resinoid, a discovery which marked the beginning of our modern plastic industry.

The growth of the industry is entertainingly presented by a series of animated and dramatic exhibits, indicating where plastics play a part in modern living. Among them are the uses of plastics in aviation, household appliances, building, business machines, abrasives, home furnishings, photography and optics, packaging, radio, machinery, fashions, automobiles, paints and varnishes, communications, amusements and music.

Interesting tests are demonstrated and a new sound-on-picture, entitled, "The Fourth Kingdom," is shown. In this picture, Lowell Thomas describes how chemical research has taken the three kingdoms, Vegetable, Mineral, and Animal, and created a fourth kingdom, whose boundaries are unlimited. Those who have previewed the Travelcade have, with pardonable exaggeration, described it as "a year's education in an hour's entertainment." When the Travelcade leaves Radio City, it will start on a city-to-city tour for a period of two months in New Jersey. After that it will be installed in the Franklin Institute, Philadelphia.

BECAUSE OF OVERLAPPING FIELDS AND OTHER considerations Celluloid Corporation decided to drop the name of Protectoid and give its transparent packaging materials the name of Lumarith—the plastic from which it is made. Beginning February 12th, Celluloid Corporation's Protectoid was known as Lumarith transparent packaging material.

CHICAGO MOLDED PRODUCTS CORPORATION recently purchased a large tract of land in Chicago on which the company plans to build a new plant costing about $159,000.

THE HYDRAULIC PRESS MFG. COMPANY HAS been allotted space 233 at The Machine and Tool Progress Exhibition to be held in Detroit at Convention Hall, March 9th to 12th. The company will display an injection molding press in full operation.

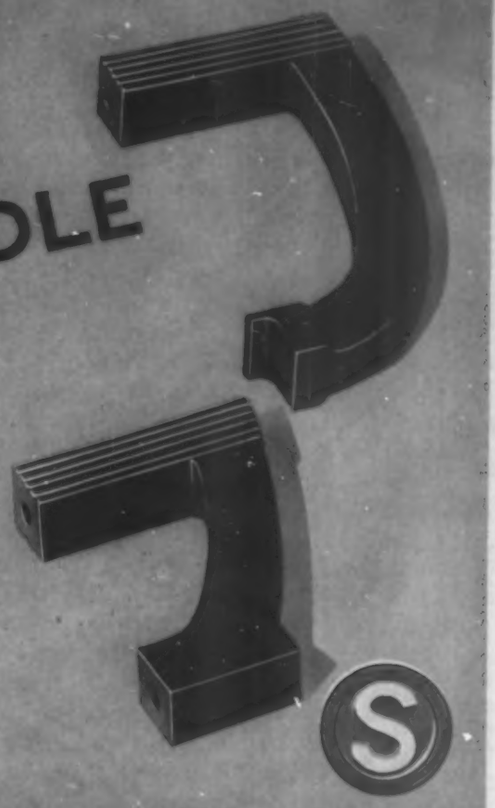
H. P. Preis Engraving Machine Company will exhibit the complete line of Deckel modern plastic mold and die production machines at Booth 358.

AT THEIR MEETING RECENTLY THE STOCKholders of The Fiberloid Corporation approved the transfer of the properties and assets of that Company to Monsanto Chemical Company in exchange for 148,523 shares of the common stock of the Monsanto Chemical Company. Out of 254,611 shares of Fiberloid stock outstanding, 244,807 shares were voted in favor of the transaction and no votes were cast against it.

WITH THE APPOINTMENT OF HARRIS D. H. CONnick as Chief Director of the 1939 Golden Gate International Exposition, it was announced in San Francisco that the Western World's Fair, a year before its opening day on February 18, 1939, stood half complete or better in nearly every important phase. Connick, with a back-

When a Problem gets

TOO HOT TO HANDLE



The Answer is **STOKES MOLDED PLASTICS**

If an economy heat wave strikes you, and you have to reduce costs, we are here to help you meet the problem. An example is these handles made of Bakelite, molded by STOKES, a company with ample facilities to take care of the largest orders. Write to address below.

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Jos. Stokes Rubber Co.

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MOLDERS SINCE 1897

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fine chemicals for PLASTICS

These products are particularly adapted to the requirements of the Plastics Industry.

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NEWS

ground as a civil engineer, was Director of Works charged with the building, operation, and demolition of Panama Pacific Exposition in 1915. Later he became vice-president of the American International Corporation, serving also as consulting engineer for many public service systems in the West.

BAKELITE CORPORATION ANNOUNCES THAT ITS new urea-formaldehyde molding compound is now available in two colors—ivory and white. Other colors will be added to the line as demand necessitates.

Also cellulose acetate molding powder in twelve different colors is ready for commercial use, and special colors will be available upon request.

INTRODUCTION OF PLIOFILM TO THE PACKAGing field is only in its infancy, yet the possible practical applications appear to be almost limitless. The packaging industry is rapidly developing these uses and adopting them to its particular needs. Pliofilm is the registered trademark identifying the pliable transparent sheet manufactured with a hydrochloride of rubber base by The Goodyear Tire & Rubber Co.

PAUL C. POCOCK, SALES MANAGER OF THE Hydraulic Press Manufacturing Company sailed recently on the Queen Mary for England and other countries on the continent including Denmark, Sweden and France.

F. J. STOKES MACHINE CO. ANNOUNCES THE appointment of Robert Platt, 20 North Wacker Drive, Chicago, as representative in this territory for the entire line of Stokes processing equipment, tablet machines, preforming presses and automatic molding presses.

THE ARMOUR INSTITUTE OF TECHNOLOGY, Chicago, is offering a course on "Applied Plastics" which deals with the methods of manufacture of laminated, cast and molded plastics, and includes a good chemical background; design of molds; engineering applications, and properties. The course is held under the direction of J. Delmonte.

PLASTIC MATERIALS WERE WELL REPRESENTED at the National Notion and Novelty Exhibit, held at the Hotel Pennsylvania in New York City, February 7–12. Included in the spring lines of various button manufacturers were a galaxy of bright colored plastic buttons and ornaments in the shape of tailored bows, hooks and eyes, fruit and vegetables, butterflies, birds, fish, twisted rope, leaves, circus clowns, and drums, and many other variations. Symbolizing the importance of plastic buttons for spring and summer dresses, one showroom was decorated with a flower shaped button, four feet in diameter, fashioned from red Pyralin, and huge Catalin buttons carved into unusual shapes.

Flower shaped button, 4 ft. in diameter and hand carved of Pyralin shown in B. Blumenthal & Co.'s display at the National Notion & Novelty Exhibit

Two-color slide fasteners of Pyralin suggest many possibilities for dress ornamentations this spring and summer. The teeth on one side of the fastener contrasts with those on the other and when the fastener is closed the two colors are combined. These were shown in such contrasts as yellow with white, navy blue with turquoise, brown with maize, and green with white. Along with these were shown many new thoughts in slide fastener pulls—miniature Mexican caballeroes, frogs, bugs, etc., all highly colorful.

A tricky new cellulose sun chapeau and a sun visor were shown in sun glass colors—amber, smoke blue, and green. There were transparent cellulose boxes, large and small, some with colorful paper top and bottom and others made entirely of the transparent material.

JACK ARMBRUSTER, NEW YORK DESIGNER, HAS joined the studio of Joseph B. Federico, industrial designer, Niagara Falls. Among the clients for whom Mr. Federico is consultant are Hickok, Dura, General Plastics, Doehler, Samson-United, Dayton Refrigerator, and Stewart Motors.

THE UNITED STATES GOVERNMENT'S $3,000,000 exhibit section at the New York World's Fair 1939 will include nine large semi-classic buildings, a spacious parade ground and a fountain-studded lagoon. The section will be dominated by the dignified and impressive Federal Building, from a balcony on the face of which President Roosevelt is slated to speak during the ceremonies attending the Fair opening.

The Federal Building and the Hall of Nations structures, which will house the official exhibits of foreign countries, will be grouped around the extensive parade

PHENOL
SANTICIZERS (PLASTICIZERS)
SANTOLITES (SYNTHETIC RESINS)
COTTON SOLUTIONS
DIBUTYL PHTHALATE
DIETHYL PHTHALATE
DIPHENYL PHTHALATE
DIMETHYL PHTHALATE
TRICRESYL PHOSPHATE
TRIPHENYL PHOSPHATE
PHTHALYL GLYCOLLATES

Monsanto Chemicals

for the **PLASTIC, RESIN AND OTHER INDUSTRIES**
have proved their ability to produce consistently superior and economical results.

Manufactured by
Monsanto Chemical Company
St. Louis, U.S.A.
NEW YORK CHICAGO BOSTON BIRMINGHAM
CHARLOTTE CLEVELAND SAN FRANCISCO MONTREAL

AMYL ACETATE
BUTYL ACETATE
ETHYL ACETATE
AROCLORS (CHLORINATED DIPHENYL)
MALEIC ACID
MALEIC ANHYDRIDE
PHTHALIC ANHYDRIDE
DIACETONE ALCOHOL
MERSOL (SOLVENT ALCOHOL)
ORTHODICHLORBENZENE

CHEMICALS OF QUALITY
Monsanto

REX SELF-DRAIN SUPPORTS

Modern Development Helps to Insure Constant Production Cycle on

PLATEN PRESSES

● Co-operating with the pastic industry, Chicago Metal Hose Corporation engineers have developed Rex Self-Drain Supports—a simplified practical solution to the problem of condensate forming in the extended loop on horizontal long-length connections. This improved type of support prevents the hose from sagging below the horizontal—successfully eliminating the water pocket in which condensate might accumulate with resulting temperature decrease. Rex Self-Drain Supports permit free movement of the unit at all times and control the flexing of the hose without unnecessary strain.

View of Rex Self-Drain Support when platen is closed PATENT APPLIED FOR

REX-TITE COUPLINGS offer new economies—removable, easily attached and reattached without packing or solder. Metal-to-metal seat forms seal impervious to temperature changes and leakage. New book gives full information on Rex-Weld Flexible Metal Hose, Rex Self Drain Supports and Rex-Tite Couplings. Send for your copy today.

CHICAGO METAL HOSE CORPORATION
Formerly Chicago Tubing & Braiding Co. (Established 1902)
MAYWOOD, ILLINOIS (Chicago Suburb)

NEWS

ground, the scene of brilliant daily spectacles, including Army and Navy drills, pageants, flag raisings and parades, in keeping with the patriotic theme in the exhibits and the decorative features of the Central Mall.

ARTHUR J. NORTON HAS SEVERED HIS CONNECtion with the Detroit Paper Products Company and established a laboratory in Portland, Maine, where he plans to do development work and serve as an independent plastics consultant.

Mr. Norton's experience in the plastics industry is broad indeed. For a number of years he was Chemical Director of General Plastics, Inc., where he serviced molding compounds, laminating materials, plywood resins, paint and varnish resins, grinding wheels and brake linings and many other miscellaneous industries which are served by synthetic resin manufacturers.

He has contributed many articles to various publications and wrote a chapter in Groggins "Unit Processes in Organic Chemistry" and "Polymerization as Applied to the Synthetic Resin Industry."

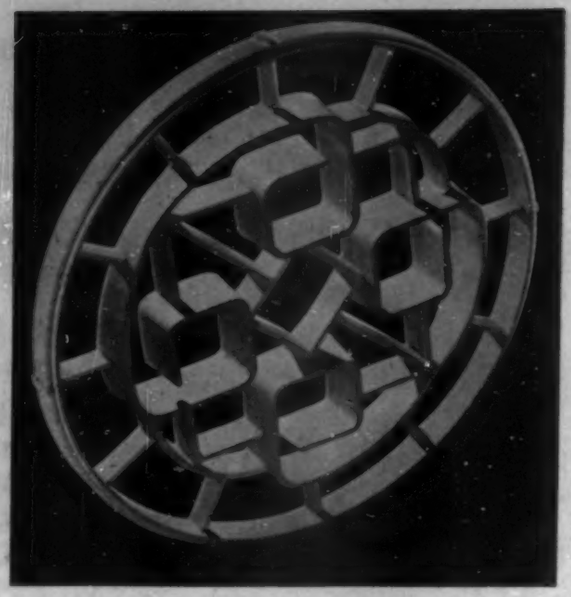
Backed by this experience he hopes to contribute to the furtherance of plastic materials in new and untried uses as well as to promote the development of their tremendous potentialities.

IN OUR FEBRUARY ISSUE WE SAID THAT THE Revolite Corporation had changed its name to The Industrial Tape Corporation, but it has been brought to our attention that all coated cloth for general purposes, diaphragm, packing material, and coated asbestos cloth are made by the Zapon Division of the Atlas Powder Company and still carry the name Revolite.

THE FOURTH ANNUAL CHEMURGIC CONFERence will be held at Omaha, Nebraska, April 25, 26, and 27, it was announced recently by Wheeler McMillen, president of National Farm Chemurgic Council. Members of Chemurgic Councils in 20 states and national representatives of Agriculture, Industry and Science will participate. The Conference programs will follow Chemurgic objectives of finding new uses for farm products as industrial raw materials.

A COURSE OF LECTURES AT THE GRADUATE level covering the general field of organic polymeric compounds is going on at the present time at the Polytechnic Institute of Brooklyn with Professor William Howlett Gardner in charge. The course consists of a series of fifteen lectures by Professor Gardner and by outstanding workers in this field.

OVERHEAD LIGHTING UNITS IN THE NEW STORE of the S. H. Kress Company, Birmingham, Alabama, make excellent use of translucent Tenite to diffuse and direct light on counters below. The louvres or grilles, one of which is shown here, are inserted into the bottom



of the hanging fixture. Light coming through the grille from above shines directly on the merchandise below while stray light on the sides is soft and diffused.

Two types of grilles are used. The one illustrated is $10^1/_2$ in. in diameter while a larger one measures three feet. In order to impart a matte or frosted finish to the plastic and further soften the light radiated to the side, the grilles were sandblasted. For this reason and also to reduce breakage, a tough resilient acetate plastic was selected. Weight reduction of 46 pounds on each of the larger fixtures was effected by the substitution of Tenite for metal. The Plastics Division of the Gorham Company did the molding.

THE 17TH SEMI-ANNUAL NEW YORK GIFT SHOW, sponsored by The National Gift and Art Association, Inc., under the George F. Little Management was held at the Hotel Pennsylvania from February 21st to March 2nd, inclusive.

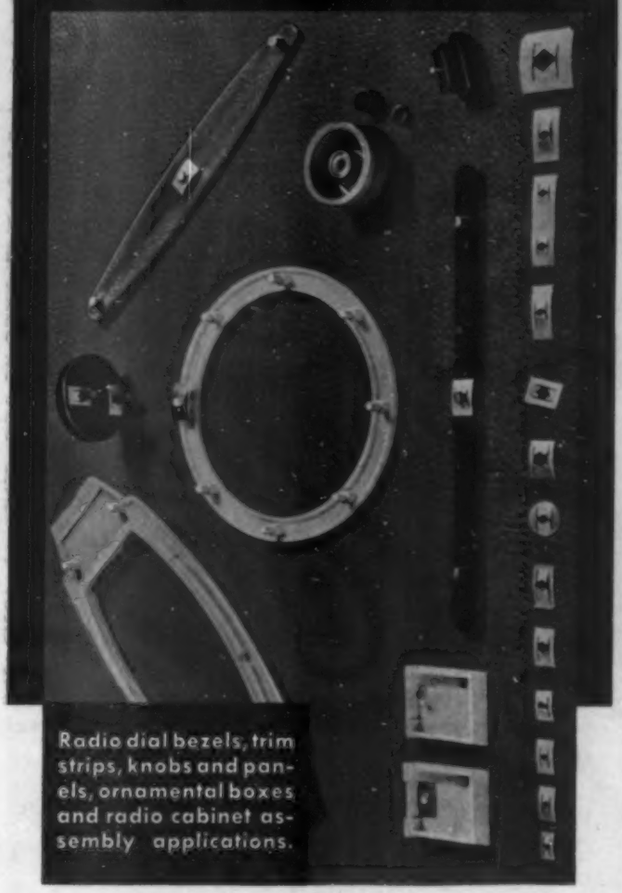
Plastics, alone and in combination with metal and glass, were copiously used. Molded handles and decoration for cocktail shakers, cocktail glasses, vases and so forth; poker chip holders of cast resin; napkin rings; salt and pepper sets; pen sets; compacts and cigaret cases, were some of the uses made of these materials and exhibited by many manufacturers.

CELLULOID CORPORATION GATHERED ITS EXecutive group and sales organization for its annual sales and advertising dinner meeting at the Downtown Club of Newark on Friday, January 28, 1938.

DANIEL J. KELLY, SALES MANAGER OF THE Marblette Corporation, Long Island City, New York, passed away at his home in East Williston, New York, on Wednesday, January 19th. Mr. Kelly came with the Marblette Corporation as a salesman seven years ago, shortly after becoming sales manager of the Corporation. Before that he was with the Catalin Corporation.

Speed Nuts

ARE "A NATURAL" FOR PLASTICS



Radio dial bezels, trim strips, knobs and panels, ornamental boxes and radio cabinet assembly applications.

In the manufacture of plastics, SPEED NUTS have proved to be a "natural." They actually "zip" on and remain tight under spring tension.

CUT ASSEMBLY COSTS

No insert required. No placing time for putting insert in mold. Lower mold cost. Amazingly effective in application over integrally molded, threaded and unthreaded studs. Over 250 different shapes and sizes are already in use. Our development engineering department is at your command to help solve your assembly problems with SPEED NUT engineering. Write for further information today.

SPEED NUT DIVISION
TINNERMAN STOVE & RANGE CO.
2048 FULTON ROAD, CLEVELAND, OHIO

Prize Winners

KNOW THE IMPORTANCE OF

MOLD STEEL

Technotrol Thermostat
Courtesy of White Manufacturing Co.
Material: Plaskon. Molded by: Chicago Molded Products Corp.

Electric Table Chef
Courtesy of Chase Brass & Copper Co.
Material: Beetle. Molded by: Plastic Molding Corp.

BOTH of the products shown were awarded outstanding honors in the 1937 Plastics Competition. Both were produced with dies made of Carpenter electric furnace Mold Steel.

The production of prize winners is not accomplished by hit or miss methods. Each individual step in their development and production must be of prize winning calibre. It is interesting to note that at least half of this year's prize winning items were produced in molds made from Carpenter Mold Steels.

A helpful 18-page bulletin shows how to get new advantages and higher properties in your molds. Write for a copy today—free to mold makers in the U. S. A.

THE CARPENTER STEEL COMPANY
112 W. BERN ST., READING, PA.

Makers of Fine Tool Steels Since 1889

PUBLICATIONS

Booklets reviewed in these columns will be sent without charge to executives who write for them on their company letterheads. Other books will be sent postpaid at the publishers' advertised prices

The Chemistry of Synthetic Surface Coatings

by William Krumbhaar

Published by Reinhold Publishing Corp., New York, 1937
Price $4.00. **200 pages**

The chemistry of a synthetic resin in the formation of which only two reacting substances take part is so complicated that very few laboratories have attempted to chart its course. But the author of this book has gone another step into the unknown to deal with the reactions which take place between the resinous macromolecules and various drying oils in varnish making. Although he admits that our present knowledge in many cases does not permit much more than reasonably founded guesses, the progress that has been made permits a more rational regulation of kettle procedure in the plant, resulting in important and substantial improvements in the properties of the dried films. The roles of driers and pigments in this process and the physical chemistry of surface coatings are considered in detail. A special chapter is devoted to the use of synthetic resins in inks for the three main methods of printing, namely, typographic, intaglio, and lithographic. The formulation of floor finishes, furniture varnishes, and spar varnishes, air-drying enamels, and various paints for building and industrial applications are reviewed in a concluding 30-page Appendix.

The simplicity of the presentation of the subject matter, the nearly complete avoidance of references to patents, the generous size of type and spacings adopted in page make-up, and the number and quality of the illustrations make for easy reading and maximum retention.

How to Handle Grievances

by Glenn Gardiner

Published by Elliott Service Co.

Price: $.25 to $.50 per copy depending upon quantity ordered in full shipment

A splendid handbook for the guidance of executives in large or small organizations where any number of employees may have real or imaginable grievances against conditions or pay. It points out the human elements which control such difficulties and if its message could be absorbed and practiced by all "bosses," little or big, labor troubles would soon be obsolete in industry and commerce. This little 52 page book should be in the hands of every man or woman in charge of "help" in every organization where labor is employed.

AN "INDEX TO A.S.T.M. STANDARDS AND TENtative Standards" is published by the American Society for Testing Materials and gives information on the 823 standards as of January 1, 1938. The Index is of service to anyone wishing to ascertain whether the Society has issued standard specifications, test methods, or definitions covering a particular engineering material or subject and it is of help in locating the standards in the volumes where they appear.

A SIX PAGE BULLETIN HAS BEEN PUBLISHED BY Reed-Prentice Corp. illustrating their No. 10 automatic hydraulic plastic injection molding machine. A colored moving picture film of approximately 400 feet has also been released covering the construction features and operation of this press. The reel is available for meetings of engineering societies and similar occasions.

BARCO MANUFACTURING CO.'S PAMPHLET NO. 290 illustrates and describes their new revolving joint with syphon attachment which has been designed for connecting fixed piping to revolving drums, and such.

BULLETIN NO. 100 WHICH DESCRIBES SEAMLESS flexible metal hose, detachable self-sealing couplings, self-flaring tube couplings and copper tubing has been issued by Packless Metal Products. Illustrations and specifications are included.

A SMALL BOOKLET CALLED "THE FURANS" describes chemicals from oat hulls and includes a page on furfural plastics and industrial applications. Published by The Quaker Oats Company.

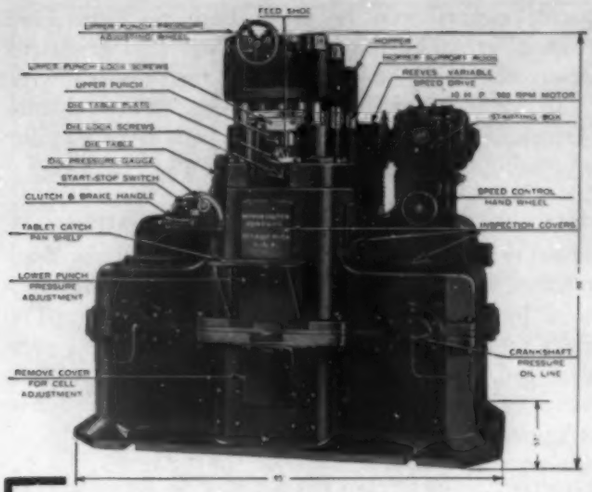
A BOOKLET ISSUED BY THE AMERICAN CONcrete and Steel Pipe Company describes the uses of Amercoat, a corrosion-proof, sprayable, plastic coating for concrete, steel, and wood.

THE ASSOCIATION OF CONSULTING CHEMISTS and Chemical Engineers, Inc., has just put out the 1938 Directory of members of the association. Each member's business association, qualifications, and activities are described.

PULVERIZING MACHINERY COMPANY'S NEW catalog shows 30 installations of pulverizing equipment in various industries and contains other information as well as tables of capacities and consumption.

THE TENTH ANNIVERSARY ISSUE OF "INSTRUments" has just been published and includes an index to instruments and apparatus, index of trade names, directory of laboratory supply houses, and directory of manufacturers and sole representatives.

AN INDEXED BOOKLET PUBLISHED BY THE American Metal Hose Branch of The American Brass Company deals with road building, machine tools, transportation, machine design, plastics and rubber molding, heating and ventilating, maintenance and production, and internal combustion engines, with suitable illustrations for each section.



COLTON

Proudly Presents

The No. 14

... 150 ton, Dual Compression Preforming Press

The finest machine of its kind ... specially designed to meet the new standards of large unit molding. All working parts sealed against dust. Pressure feed oiling to all bearings. Maximum cell depth ... $3^{3}/_{4}$", maximum dia. round tablet ... $4^{1}/_{2}$". Speed 25 to 30 tablets per minute. Double toggle, twin crankshafts ... hence compression from *both* sides of tablet insuring uniform density throughout.

Send for full details about this and other Colton preformers for every molding purpose.

ARTHUR COLTON CO.

2604 E. Jefferson Avenue DETROIT, MICHIGAN

COLTON DETROIT

LEAROK

THE BUFFING COMPOUND WITH NO FREE GREASE

The Clean Buffing Compound

LEAROK has no "free grease" in it. It is clean. It doesn't get into crevices and ornamentations. This, coupled with its excellent buffing properties, make it ideal for finishing plastics. LEAROK can be obtained tinted to match the color of the finished article.

Send a sample of your work for our recommendations.

The Lea Mfg. Co.
Waterbury, Conn.

Canadian Agents: Lea Products Co.
686 Notre Dame St. West, Montreal, Canada

Don't Give Up Trying to Reduce Production Costs ...
Not Until You Have Tried

FARQUHAR

High Speed Hydraulic Production Presses

with the last word in Automatic Controls.

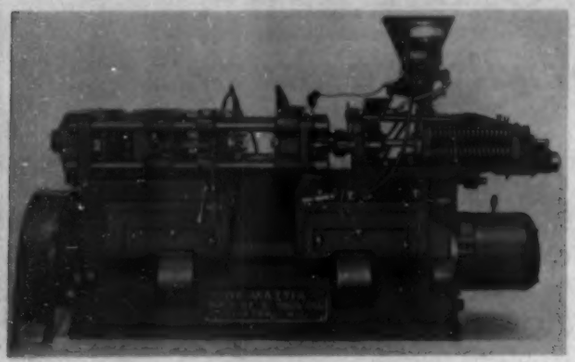
Write for

Illustrated Folder

showing the wide range of hydraulic presses we are in position to manufacture at reasonable prices.

A. B. FARQUHAR CO., Limited
Box H3, **YORK, PA.**

EQUIPMENT



A NEW INJECTION MOLDING MACHINE WHICH is fully automatic is announced by the De Mattia Machine & Tool Company. A powerful mold-closing unit closes and opens the mold quickly while the die is held closed with a force of 200 tons. Some of the specifications are as follows:

Molded material per injection	3 oz.
Injections per hour	120 to 450
Injection pressure	15,000 lbs. per sq. in.
Maximum projected area of molded parts	24 sq. in.
Maximum power consumption of heating unit	1.5 K.W.
Motor furnished	7.5 H.P.
Weight of machine, including motor (approx.)	6,000 lbs.

A folder is available to those interested.

LAMINATED PIPE ENDS ARE MANUFACTURED by Continental-Diamond Fibre Co. which have high electrical insulating properties, good mechanical strength and are unaffected by water, chemicals, or rapid temperature changes. They are designed to prevent dangerous grounds and are made in two styles; threaded to fit standard pipe and conduit thread; or plain with three set screws for fastening.

DESIGNED TO MEET THE NEEDS OF BOTH THE machine shop, the pattern shop and the cabinet shop, two new disk sanders just announced by the Delta Manufacturing Company fill the gap between light machines previously available and the heavy, permanent installation machines. The new machines are heavy enough for accurate finishing, squaring, mitering, fitting and sanding on wood, metal, plastics and many other materials, yet portable enough to be used throughout the shop wherever they will be most efficient in the machine shop or assembly line.

One model is a direct-driven type, with a base upon which may be mounted a 1/2 or 3/4-H.P. motor. The other model is belt-driven, and is designed to be used with an existing drive, or where odd voltage or frequency motors must be used. Both machines have 12 in. disks, 10 by 16 in. tilting tables with graduated sectors for angle of tilt. Tables are provided with 3/8 in. by 3/4 in. groove for miter gage or for guidance of special fixtures. The shaft of the belt-driven machine is carried on self-sealed ball bearings.

FULL VISION LENSES, WHICH PERMIT THE wearer to see, read, work, walk and observe surroundings in safety, feature the new full vision gas masks manufactured by the Acme Protection Equipment Co. The lenses are made of scatterproof laminated polished plate glass and afford 90 percent vertical and 170 percent lateral vision. These new canister masks are available in corrugated tube and snout types.

THWING-ALBERT INSTRUMENT COMPANY HAS produced a "Treasure Chest" which provides a potentiometer equipped with complete facilities to check the calibration of other pyrometers while they are in service. An inaccurate pyrometer may cause serious losses in a plant, and regular and frequent checking with the Treasure Chest will detect any inaccuracies quickly.

"WERE THEY ALL POOR PEOPLE?"

(*Continued from page 25*) versatile material fully capable of translating their creative efforts into merchandise that will *live* and be useful in the years to come.

Radio in this instance is taken simply as an example. It, perhaps, has no greater nor lesser opportunities than other industries to develop and progress through a more complete understanding of these new materials. Engineering and appearance design, however, must be considered together for the one without the other will not endure for any length of time.

Even with our knowledge that this picture is posed and the title fictional, it represents the attitude of a rapidly growing generation toward outmoded merchandise of bad design which manufacturers can't escape and shouldn't ignore. The attics of tomorrow will continue to reap their rewards from the products of today.

DISPLAYS THAT LOOK REAL

(*Continued from page 26*) 3 to 4 seconds. When the press is opened, a highly polished, exact reproduction results and a small surrounding margin remains for attaching to the display. It is then colored, if necessary, and the "flash" cut off to about four tenths of an inch wide. At this stage labels or other decoration are applied. The flange and opening may be covered if required by a backing of paper, plastics, metal and so forth and attached with a suitable adhesive.

Most effective results can be achieved with reproductions of glasses containing liquids such as perfumes, whiskeys, milk, beer, sodas or portions of ice-cream, sundaes, fruit salads, or jellies. Lighting from behind

ELMES

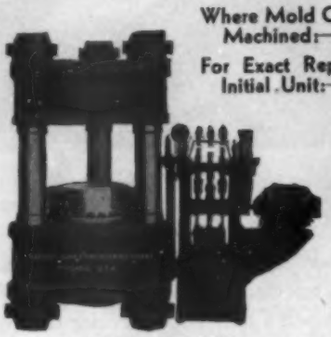
DIE SINKING PRESSES

OFFER ADVANTAGES IN HOBBING OVER MACHINING ESPECIALLY

Where Mold Cavities cannot be Readily Machined:—

For Exact Reproduction, Accuracy of Initial Unit:—

For Surface Designs of Lettering or Embossing



MODEL NO. 2095
With H. & L. P. Pump

OUR PRESSES INSURE THE MOST IMPORTANT FACTORS OF IMPRESSION BY ACCURATE ALIGNMENT AND RIGID CONSTRUCTION.

Built in Any Size or Capacity, Hand Operated, Belt or Motor Driven

CHARLES F. ELMES ENGINEERING WORKS

225 N. Morgan St., Chicago, Ill., U. S. A.
HAYmarket 0696

DIEMOLDING CORPORATION

Canastota, N. Y.

TRADE DM MARK

A complete and thoroughly equipped molding plant with an enviable record of performance for many of the largest users of molded parts, products, premiums and packages

Call upon our engineers and designers for aid or advice in planning your molded parts.

DIEMOLDING CORPORATION
CANASTOTA NEW YORK

A GOOD

FINISH

IS A GOOD START TO

SALEABILITY

Siebert barrel tumbling finishing methods for synthetic and natural materials will give you *economically* the finish your product needs —from brilliant high lustre to dull sand blast finish.

Manufacturers of
Solid Hard
MAPLE & ALL-STEEL BARRELS

SIEBERT SERVICE—Inquiries are solicited on new products or on unusual problems. Or send us a test lot of your product for experimental run —we will submit full report without charge.

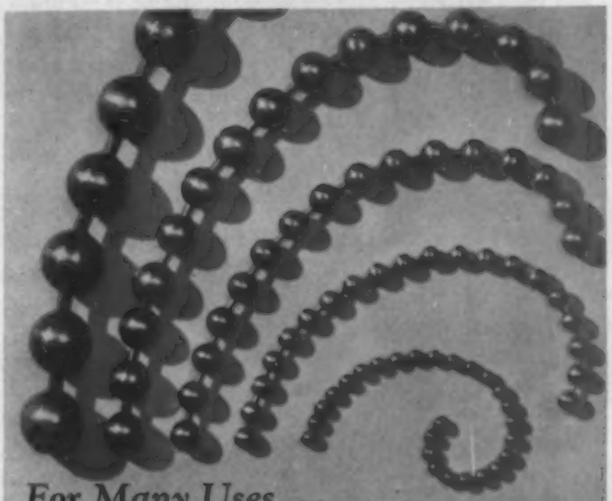
EQUIPMENT, MATERIALS, PROCESSES FOR BAKELITE ... LUCITE ... CELLULOSE ACETATE ... UREA ... CAST PHENOLICS ... CELLULOID

Rudolph R. Siebert

Originators of Dry Barrel Polishing

183 ST. PAUL ST.
ROCHESTER, N. Y.

NEW YORK OFFICE:
18 WEST 27th ST.
Murray Hill 4-6458



For Many Uses...

BEAD CHAIN*

Non-kinkable, metal BEAD CHAIN* is made in the sizes shown here, of varied metals and finishes, for beauty and utility. There are pendants, couplings and attachments for any assembly.

Our engineering and design service is available to fabricators, molders and others in the Plastic industry, to assist in the development of new and improved products.

THE BEAD CHAIN MANUFACTURING CO.

*TRADE MARK REG. U. S. PAT. OFF.

BRIDGEPORT, CONN.

with a flasher or steady light makes these displays suitable for use at night on an otherwise unilluminated portion of a window or counter.

The advantages of this type display are readily recognized by companies who have sought the third dimension with no success or with great expense. Through the use of plastic reproductions longer life, greater attraction, and more natural and effective displays have resulted.

AS A MATTER OF RECORD

(*Continued from page 23*) are almost too numerous to record. The United States Government, well acquainted with all aids to modern business and accounting procedures, has adopted photography in connection with the problem of keeping a record of Treasury checks. With the development of Social Security there is much reference to the files in the U. S. Department of Commerce, Bureau of Census and many of these records were already in poor shape through natural deterioration and use. The Social Security Bureau installed photographing equipment and is now well along with the operation of placing all these invaluable records on safety film. The original files, some in loose leaf form, some in large bound books, some in card form, will be safely stored away and all reference to their information will be through the film with desk type projectors.

Also millions of forms are being received in the Social Security Bureau of the Government and should they be filed incorrectly or lost through handling, it would be a serious matter. To safeguard against this possibility, the tremendous volume of Social Security reports are being placed on film and the film will be stored in vaults to be referred to only in case of loss of any of the original records. Photographing equipment is also being used in connection with the National Parks Service.

One business organization in the South West has installed photographing equipment for the photographing of various real estate records and files a film picture of various title abstracts with a photographic copy of the territory taken from an airplane.

More recently, libraries have turned to cellulose acetate film as an economical means of reproducing rare and valuable manuscripts. Each university and public library has a number of copies of out of print and priceless books that of course can not be taken from the libraries. By placing the books on film form, it is possible for many readers and students to have access to these records which formerly could only be seen by visiting the libraries possessing them. Recently, a professor in an Eastern college secured a film copy of such a book from London for approximately $17.00 which enabled him to work directly from a desk type projector in his own study, instead of having to go to England which would have required considerable time and expense. He could not have obtained the book in any other way.

Most libraries are constantly in need of space for new books which makes it impossible for them to retain extensive files of newspapers for reference. Naturally,

Photographing large records in unbound form at U. S. Department of Commerce, Bureau of Census

newspapers being a day to day history of world and local events are much referred to, and the demand for this material has developed a newspaper service whereby publishers and librarians can now photograph newspapers on 35 mm. film which occupies a small fraction of the space required for the keeping of the former bound volumes and costs little more than the cost of binding standard newspapers. One library is now photographing current editions of seven newspapers, and other libraries and individual newspaper publishers throughout the country are engaged in photographing programs. In prominent city libraries batteries of three and four projectors are set up in the Newspaper Rooms and all reference to certain newspapers is by means of the film.

With the development of the photographing of newspapers, many publishers and libraries immediately started plans for the photographing of back files which were rapidly deteriorating. The World War Period of the New York Times was photographed and film copies sold to libraries throughout the country. The New York Herald Tribune started photographing back files from 1841 up to the time of their current papers. The Johnstown Tribune and Democrat photographed files that had been through the famous Johnstown flood and Historical Societies started the photographing of valuable records in newspaper form.

An example of the size of film compared with the original bound files of newspapers is the film copies of the New York Times from January 1, 1914 to December 31, 1918 which occupy but $1\frac{1}{8}$ cu. ft. of space as against 59 cu. ft. of space required by the original files.

Not only does the photographing of newspapers on film preserve them and make it possible for a library to keep many more than was formerly possible, but it is much easier and cleaner to place a roll of film, $3\frac{1}{16}$ inches in diameter and $1\frac{3}{8}$ inches in thickness on a projector than it is to get a 17 lb. bound volume from a shelf for a reader. Where several volumes are wanted the saving in time is considerable and readers immediately appreciate this more modern method of reference to newspaper files. (*Please turn to page 64*)

Swivel 7AS-8CS

BARCO SWIVEL JOINTS

Swivel 7AS-8BS

● Don't take chances on expensive shutdowns and production delays. Where pipe movement is involved, depend on BARCO joints to solve your problem.

Swivel 7S-8BS

BARCO MANUFACTURING COMPANY

1813 Winnemac Ave., Chicago, Ill.

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No ordinary cotton flock is this new Claremont development, but a completely new material, made on unique machines designed and patented by Claremont engineers and available exclusively at the Claremont plant.

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Cellulose acetate film has proven to be a tough unbreakable material, and accelerated aging tests made by the National Bureau of Standards have shown that acetate film if well made, properly developed and fixed is as stable as paper used for permanent records. The stability of film was determined by measuring the effects of accelerated aging on some of its properties. The properties tested were: flexibility, which is the physical property most closely related to use requirements, was measured by a folding test; acidity, which is a measure of the harmful acid present, was expressed as pH value; the copper number, a measure of the degraded cellulose present, was determined; and the relative viscosity in acetone solution was measured. A lowering of this viscosity is considered an indication of breakdown in molecular structure of a cellulose compound. These tests were made on samples before and after accelerated aging, and the results compared to find the changes occurring.

In the summary of Research Paper RP950 from the U. S. Department of Commerce, National Bureau of Standards, it was stated that, "On the basis of the test data, the cellulose acetate type of safety film appears to be a very stable substance. It is a comparatively new material on which no natural aging data are available. However, data on the relative resistance to accelerated aging of the acetate film, nitrate film and permanent record papers are very favorable to the acetate film. A specification, proposed by Scribner, for permanent record paper of the highest quality, requires a retention of folding endurance of 85 percent after heating 72 hours at 100 degrees C. Acetate film retained 50 percent after 150 days at the same temperature. Nitrate film, known to be relatively impermanent, had no folding endurance after 10 days of heating. The relatively high chemical stability of acetate film is shown by the fact that aged samples showed no increase in acidity, whereas nitrate film became distinctly acid."

The summary goes on to state that, "While it is not possible to predict the life of acetate film from these results, the data show that the chemical stability of the film; with respect to oven-aging, is greater than that of papers of maximum purity for permanent records. On the basis of this comparison, cellulose acetate motion-picture film appears to be very promising for permanent records."

The use of cellulose acetate film in business and in the library and newspaper field has developed so rapidly in a comparatively short time that it is impossible to predict just how far it will go. Librarians, however, have stated that in their opinion libraries in the future will consist of rolls of film containing pictures of books, manuscripts, newspapers, etc. and at library tables will be rows and rows of projection equipment for the reading of the films.

Reading equipment for the showing of 16 mm. and 35 mm. cellulose acetate film pictures differs considerably from the type used for the showing of motion pictures. In order to give the impression of figures moving on a screen, motion picture projection equipment is designed so that by means of sprockets the film is pulled down before the light source at a given speed and shutters operate in front of the film to give the impression of motion. Still projection equipment does not require sprockets, and since the film is pulled down before the light source manually, all the complicated mechanism required in motion picture equipment is eliminated. A much stronger light is also required for motion picture equipment than is required with still projectors. The very first reading units brought out were designed from home motion picture projectors with a screen placed several feet from the reader and on which the film pictures were shown. In a very short time, however, desk type projectors were designed whereby a reader could place a roll of film in a unit and have the image projected against a mirror and brought back to a translucent screen directly in front of the reader and at eye level. Of course, there were several variations of this type of projection and the last and final step was the designing of a projector for continuous reading where the film could be placed in the top of the unit and image projected down to an opaque screen slightly above the level of the desk and enclosed on three sides to exclude extraneous light. With the projector placed on a table and the image appearing at desk level, it is possible for readers to make notes from the projected images just as they would from an open book or newspaper. This is the type of projection equipment used in libraries throughout the country for the showing of newspapers, etc., in film form, and by many organizations where there is considerable reference to film pictures.

Business men prophesy that executives will, in the future, have projectors on their desks and confidential reports, sales reports, credit reports, etc., will be received on film in a tamper proof, extraction proof form. Thousands of reports may be kept in film form in small desk drawers. Organizations manufacturing equipment for photographing uses in business are constantly receiving suggestions for the development of film in business, which is an indication that the business world is in general film-minded, and that there is a tremendous future for photography in commerce and industry.

SCIENCE DEMANDS ACCURACY

(*Continued from page 27*) recent change to a molded plastic housing improved the appearance of the device, lowered its ultimate cost and made it light enough to carry about in the pocket comfortably.

There was another advantage, however, more important to the success of the instrument than any of these. The lower "specific heat" and lower "coefficient of transmission" provided by the plastic material as compared with any metal improved the accuracy and sensitivity of the instrument by reducing errors from radiated or conducted heat to or from the thermometers.

The psychrometer consists of a good pair of thermometers, perfectly balanced, arranged so that the necessary aspiration over the bulbs is induced by a steady jet of air applied from a hand pump. Gentle pumping on the

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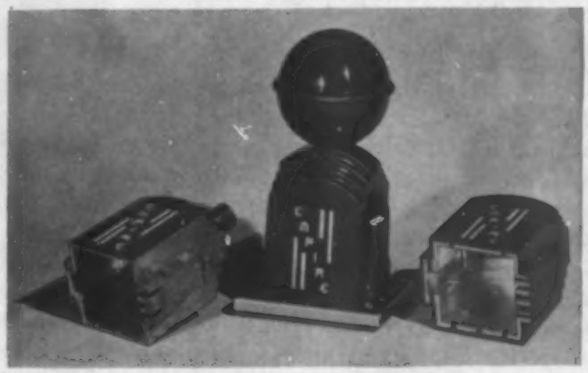

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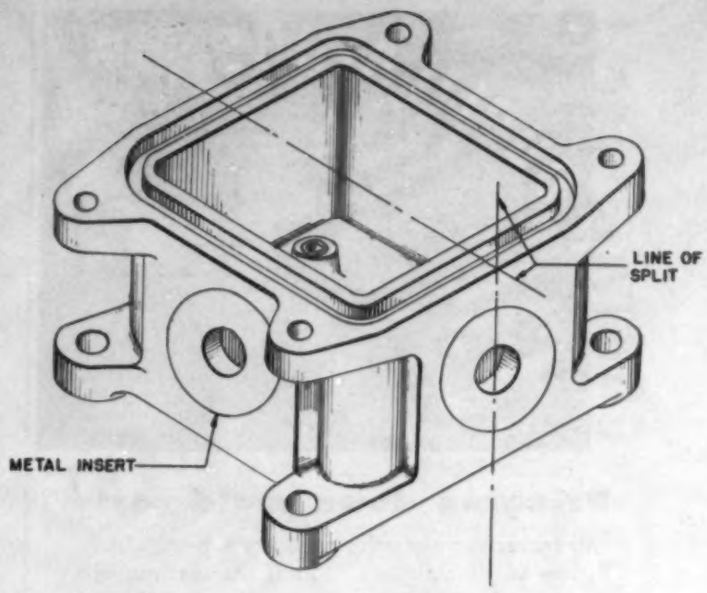
hand pump inflates the flexible reservoir which is protected from over-inflation by a net covering. The reservoir evens out the impulses of the hand pumping operation and provides a steady flow of air to the nozzle.

The nozzle protected by a filter is located inside the Venturi tube where the action of this jet of air is to induce a larger supply of air to be drawn through the tube via a chamber which surrounds wet and dry bulbs of the thermometers to give true wet and dry bulb temperatures. The wet bulb is provided with a wick to which water is applied with a dropper from a bottle for which space is provided in the leather case which holds the complete instrument with its equipment.

The cover of the hinged plastic case when opened provides a convenient handle for holding the instrument and since the material itself is molded insulation no body heat is transmitted to the thermometers to distort their accurate reading.

Included is a Friez psychrometric slide rule which eliminates the necessity of carrying a bulky book of tables or complicated charts for ordinary humidity readings. Seven and five-eighths inches long it has accuracy sufficiently close for most practical work and relative humidity is quickly determined through its use from the figures obtained from the wet and dry bulbs.



MOLDED BOX.

FIG. XI

MOLDS FOR PHENOL RESINOIDS

(*Continued from page 46*) differences of opinion arising among the manufacturers regarding these molds, further molds of this type may not be purchased.

Positive sub-cavity molds

Positive sub-cavity molds were mentioned under the "Flash Mold" classification and the description under that heading is sufficiently complete to form an idea as to the operation of this type. As the likelihood of this type of mold being used for new production is small, no further discussion of this type is considered necessary.

Under the "Construction" classification there are listed four types of molds not yet touched upon. These types are the Split Follower, the Ring Follower, Split Cavity, and the Floating Chase which are found as modifications of the positive types of molds.

Positive split follower molds

The split follower molds is usually landed positive. This type of mold makes possible the molding of pieces having projections of such form that would prohibit the removal of the finished piece from a "solid" chase mold.

The cavity bearing number or "follower" is split into two or more pieces and when assembled, fit tightly into an aperture cut in the chase to receive it. The follower sections are keyed together. The mold is operated the same as the basic type except that to remove the molded piece, the entire follower is ejected as a single unit, then opened for the ejection of the piece.

Certain requirements have been developed for the split follower type of mold for Navy use as follows: The outer sides of the split followers should be vertical and the wall thickness should be a minimum of one inch. The material for these pieces should be the same as specified for the chase of unit construction molds. The split followers are required to "bottom" against the bottom follower or plug, a minimum of $^5/_8$ inch.

Fig. 10 shows the arrangement of a Built-Up Construction (Split Follower), Indirect Heated, Hand, Single Cavity, Truly Positive, Complete Closure, Knock-out Plate Ejecting Mold. Fig. 11 shows a typical box with projecting lugs requiring the use of the split follower type of mold.

Positive ring follower molds

The positive ring follower mold makes possible the molding of circular pieces having a section of threaded exterior surface, which otherwise would involve a difficult ejection problem. The ring follower may extend just the length of the threads as called for by the design, or it may enclose the complete molded piece. In either case the ring follower is ejected with the piece as is the case of the split follower, and the piece then unscrewed from the ring.

As the name implies, the ring follower is a ring whose exterior surface fits closely the aperture in the chase, and which has a threaded interior which forms the threads of the molded piece. The follower should be of steel equal to that required for the cavity. The performance of the mold is the same as the basic type.

Positive split-cavity molds

In certain instances it is found impracticable to machine the chase or die to the shape of the piece to be molded, and yet no difficulty in ejecting the piece is in-

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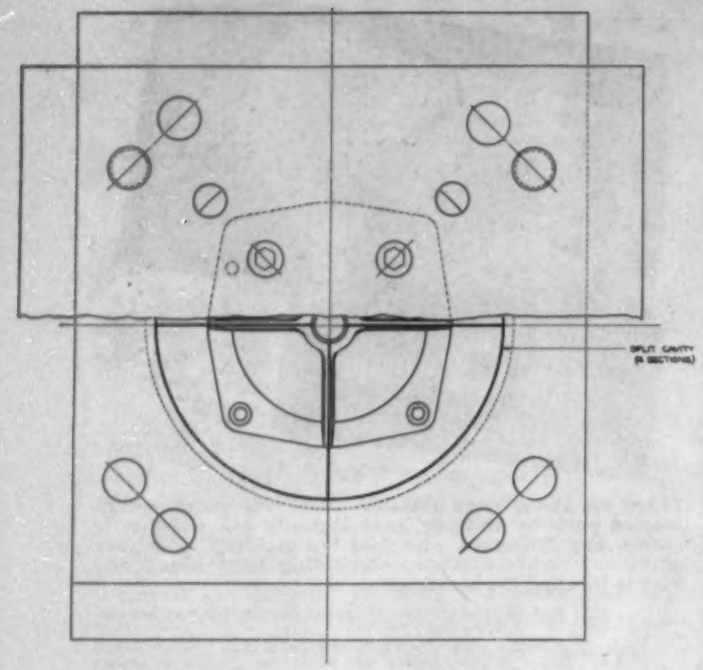
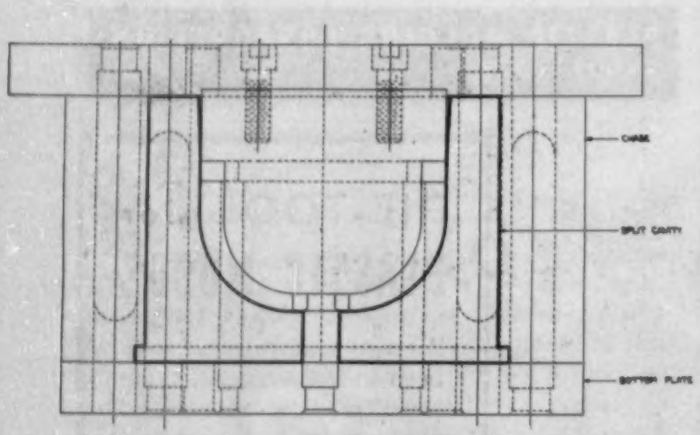




BUILT UP CONSTRUCTION (SPLIT CAVITY) INDIRECT HEATED, HAND, SINGLE CAVITY, TRULY POSITIVE, COMPLETE CLOSURE, KNOCKOUT PLATE EJECTING MOLD

FIG. XII

volved that would require the use of the split follower type of mold. For such applications a built-up construction mold is used with the die made in two or more pieces. These separate pieces are then forced into the chase, forming a permanent construction.

The applicability of split-cavity molds is determined by the shape of the piece to be molded.

Fig. 12 shows the arrangement of a Built-Up Construction (Split Cavity), Indirect Heated, Hand, Single Cavity, Truly Positive, Complete Closure, Knockout Plate Ejecting Mold.

Positive floating chase molds

The floating chase type of mold is a positive type, but of special design and limited use. It consists of an upper and lower force plug, and a chase which is free to move in the direction of movement of the force plugs.

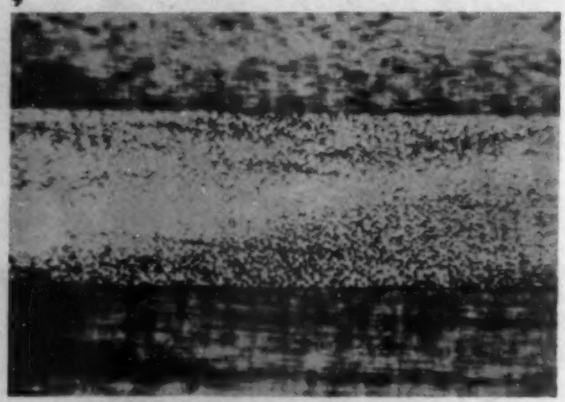
The mold is charged with the lower plug retracted (or the chase raised) sufficiently to distribute the charge equally above or below the center of the chase. The molding pressure is then applied equally by the two plugs with the chase free to move. During the molding operation the chase floats to a position of equilibrium with respect to the friction of the molding charge, so that the same molding pressure is applied at each end of the piece and variations in density of the molded part are reduced.

This type of mold is primarily applicable to the molding of pieces whose vertical height is great with respect to the horizontal dimensions, when such height is sufficiently great to cause appreciable variation in density from top to bottom, if molded in an ordinary positive mold. It is primarily intended for use with powdered material, but in special cases may be applicable to the molding of tabletted material. This type of mold may have its application for Navy work but may be considered, at least for the present, as having a very limited application. *(To be continued in April.)*

PHENOL AS PLYWOOD ADHESIVE

(Continued from page 42) part of the curve for the shear strength after boiling (Fig. 5), shows a rapid rise after a minimum required pressure had been exceeded. Once a maximum strength value had been attained, the strength falls off rapidly. Figs. 5 and tables II and III indicate these facts. For pressures beyond the elastic limit the

9



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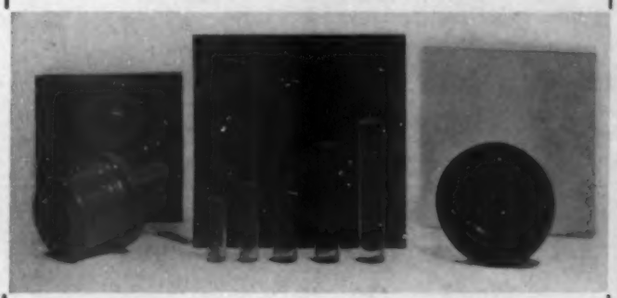

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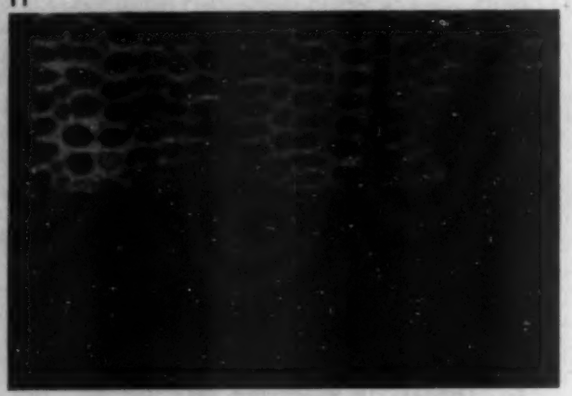
shear strengths become quite low. This probably is the result of the swelling of the crushed wood fibers which damages the bond.

Figs. 9 to 12 and the data in table V show the contact between plies bonded with sprayed phenol-formaldehyde resin and between bonded plies using either casein glue or phenol-formaldehyde resin applied as a dry glue film. The dry glue film method gave a more uniform distribution of the resin. Distortion of the wood fibers is quite noticeable in Fig. 12.

11



12

Conclusions

1. Phenol-formaldehyde resin gives a satisfactory moisture-resistant bond for plywood when bonding conditions are properly controlled. It is satisfactory for use with maple, birch, cottonwood and red gum.

2. The resin can be applied to both surfaces taking part in the bond by spraying a 20 percent solution of resin in acetone. Satisfactory results demand the use of 1 pound of resin per 10 square yards of wood covered.

3. Bonding temperature should be as high as possible without damaging the wood. This results in the greatest moisture resistance and a minimum bonding time. The range is from 375–400°F.

4. Pressures should exceed 100 pounds per square inch and should be below the elastic limit of the wood used. Excessive pressures are to be avoided. For soft woods 150 pounds per square inch is sufficient but for hard woods 250 pounds per square inch may be used.

5. Time of bonding depends upon the temperature and pressure used. For the conditions recommended above a time of 5–8 minutes is best.